LITTORAL COPEPODA FROM SOUTH AUSTRALIA (II) CALANOIDA, CYCLOPOIDA, NOTODELPHYOIDA, MONSTRILLOIDA AND CALIGOIDA

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THE first part of this paper appeared in Vol. VI, part 4, of this Journal and dealt exclusively with the Harpacticoida. The present contribution deals with the remaining groups, all of which are represented. The text of this paper was completed in December, 1941, but could not be published at that time. Since then no publications on these groups have come to my notice calling for any modification of the present paper.

In the introduction to the first part the distribution of the different samples comprising the collection was set out with relevant data, and a number applied to each sample. These numbers are used here when indicating the occurrence of each species. In addition, a list of the samples and the species found in each is given at the end of this paper.

The same methods of staining and mounting have again been used and, as was the case when dealing with the Harpacticoids, the drawings have all been made with the aid of a *camera lucida*, and the preparations deposited in the South Australian Museum.

The following abbreviations have been used in the figures:

a.1, first antenna.
a.2, second antenna.
ant., anterior.
a.s., anal segment.
cl., claw.
c.r., caudal rami.
dors., dorsal.
end., endopod.
exp., exopod.
lab., labrum.
lat., lateral.
lt., left.
md., mandible.
md.p., mandible palp.
mx., maxilla.
mxl., maxillule.
mxp., maxilliped.
o.c., oral cone.
par., paragnath.
p.1–5, legs 1–5.
post., posterior.
R., rostrum.
rt., right.
Si., siphon.
Ur., urosome.
vent., ventral.

CALANOIDA.

Family PARACALANIDAE Sars 1902.

Genus Acrocalanus Giesbrecht 1888.

Giesbrecht & Schmeil, 1898, p. 25.

Acrocalanus gracilis Giesbrecht.

Scott, A., 1909, p. 29; Sewell, 1929, p. 79; Farran, 1936, p. 81; Dakin and Colefax, 1940, p. 93.

Occurrence. III, 5 males (0·78 – 0·85 mm.), many females (0·74 mm.).
This widely distributed member of the plankton was taken in Spencer Gulf.

FAMILY PHAENNIDAE Sars 1902.

A single specimen of what appears to be a male of the genus *Pseudophaenna* occurred in one of the collections (III). Without the corresponding female it is difficult to ascertain its systematic position with certainty and the description will therefore be withheld until further material has been obtained.

FAMILY CENTROPAGIDAE Sars 1902.

Genus GLADIOFERENS Henry 1919.

Henry, 1919, p. 31; 1922, p. 559.

The genus contains five species: *pectinatus* (Brady, 1899), from coastal waters of New Zealand; *brevicornis* and *spinosus* Henry (1919) described from freshwater in New South Wales, the former being subsequently recorded and fully illustrated by Dakin and Colefax (1940) from the coastal plankton of that region; *gracilis* Kiefer (1931) from freshwater in New Zealand; and *subsalaria* described by Percival (1937) from New Zealand lakes. The new species described below was taken at Blanche Harbour at the north end of Spencer Gulf.

Brady (1899) described (p. 36) and figured (pl. ix, fig. 24–7) a species, *Centropages pectinatus,* which almost certainly should belong to this genus. Unfortunately the specimens were damaged and so his description is very incomplete, but from the structure of the fourth leg (fig. 24) which bears a large curved spine on the coxal segment, and the fifth leg which has the inner claw on the middle segment of the exopod strongly curved and, in general, shows the reduced armature found in *Gladioferens,* I have little hesitation in assigning Brady's species to this genus. Its occurrence is not inconsistent with this conclusion since it was found in the coastal waters of New Zealand and the genus has been recorded both from that region (two species) and from coastal waters (Dakin and Colefax, 1940, and the present collection).

With regard to the fourth leg of the female in this genus Henry (1919, p. 31) states that *each leg* bears "a long curved sword-like spine on the inner edge" of the basal segment and this statement is repeated in the descriptions of the two species (pp. 33, 34, 37), and is not corrected in her later paper (1922). Dakin and Colefax (1940, p. 91), describing a species identified as *G. brevicornis,* point out that this spine occurs only on the left side, which is in conformity with the condition in the species described subsequently. (It may be noted in passing that specimens collected in 1939 from the Swan River, Western Australia, were indistinguishable from *spinosus* except that the enlarged spine was found on only one of the fourth legs; only females were taken so that it is uncertain whether this was correctly identified as *spinosus*). It is possible that Henry was in error in describing this spine as symmetrical, the alternative being that it is variable, but there is no evidence to support this.

It is doubtful if *subsalaria* is really distinct from *brevicornis,* as identified and figured by Dakin and Colefax; there is a remarkable agreement in detail in the shape and armature of the male second, third and fifth legs and terminal segments of the right first antenna; the female genital segment of *subsalaria* as shown by Percival might well be that of *brevicornis.* The right endopod of the fifth leg of the male of *brevicornis* is described by Henry as one-segmented, but the figure suggests three segments, which further supports the possibility of their being synonymous. The alternative, that Dakin and Colefax are really dealing with *subsalaria* and that this is distinct from *brevicornis,* is improbable but can only be decided by reference to the original material in each case.

It is possible also that *pectinatus* (Brady) is synonymous with *brevicornis* or *subsalaria* (if these are distinct) but Brady described the female only. His figures, however, suggest *brevicornis* (as figured by Dakin and Colefax) a noteworthy feature of similarity being the swollen bases of some of the caudal setae common to both species. If these species are synonymous Brady's name will, of course, have to replace *brevicornis*.

The preparation of a key to the females of this genus is at present not practicable partly because there are no outstanding differences between the species, but chiefly because the form and armature of the body, and in particular the urosome, which would probably be the best characters for differentiating the females, have not been described in every case. The key to the males presents little difficulty, and the fifth legs of these have already been used for that purpose by Henry (1922).

KEY TO THE MALES.

1. Both rami of left fifth leg 3-segmented .. .. .. *spinosus* Henry 1919.
   Both rami of left fifth leg 2-segmented .. .. 2.
   Exopod 2-segmented, endopod 1-segmented .. .. 3.
2. End segment of left second endopod armed with a spur at right angles to axis of segment, and seven setae .. .. *gracilis* Kiefer 1931.
   End segment of left second endopod armed with spur directed towards base of legs, two spines and five setae .. .. *inermis* sp. nov.
3. Right fifth endopod 3-segmented .. .. .. *subsalaria* Percival 1937.
   Right fifth endopod 2-segmented .. *brevicornis* Henry 1919 (Dakin & Colefax 1940).

GLADIOFERENS INERMIS sp. nov.

Occurrence. III, 4 females (3 ovigerous), 1 male.

Female. Length 1·09 mm. The urosome is elongate and slender as in *gracilis* but the third segment is more elongate and the caudal rami more slender than in that species. The outer marginal seta on the caudal ramus is inserted at three-fours of the distance along the margin in *gracilis*, whereas in this species it is nearer the end. The coxal spine on the fourth leg is more slender and of a distinctive shape.

Male. Length 0·98 mm. Body of similar shape to that of the female; the urosome is 5-segmented and the caudal rami are not greatly elongated. The right first antenna is modified for grasping, 18-segmented, and having a small terminal claw. The second legs are asymmetrical, the left endopod having the proximal inner seta of the end segment modified into a stout spur. The basal segment of this endopod has its inner proximal corner extended into a spur-like process directed towards the base of the leg. The third and fourth legs are alike, symmetrical and like those of the female, except that the coxal seta is transformed into a spine on each leg, including the second, and is the same on both legs of each pair. It increases in size progressively from the second to the fourth legs. The fifth legs are asymmetrical; the left exopod is 2-segmented and armed with spines, the endopod is 2-segmented, having the large basal segment imperfectly divided, and the terminal segment is armed with four short spines. The right exopod is 3-segmented; the basal segment has an inner distal rounded process, the middle segment is large and prolonged distal to the insertion of the outer spine: it bears an inner basal process, armed with a few spinules and has its inner margin concave; the terminal segment is short, armed with a large terminal and a small outer spine. The endopod is 2-segmented, more slender than that of the left leg and expanded basally.

The first segment of the urosome bears a small lateral process on the left side; the lateral seta on the caudal ramus is inserted at about two-thirds along its length.

In the structure of the fifth legs the male of this species most closely resembles

that of *gracilis,* both differing conspicuously from the other species in this feature. The middle segment of the right exopod has an almost straight inner margin in Kiefer's species, quite different from the condition in *inermis* and the accessory spine on the end segment of this exopod is minute in *gracilis,* whereas here it is strongly developed. The armature of the end segment of the left endopod also differs in these two species. In the fourth leg the terminal spine on the exopod is relatively more slender and less strongly armed than in *gracilis* and in the

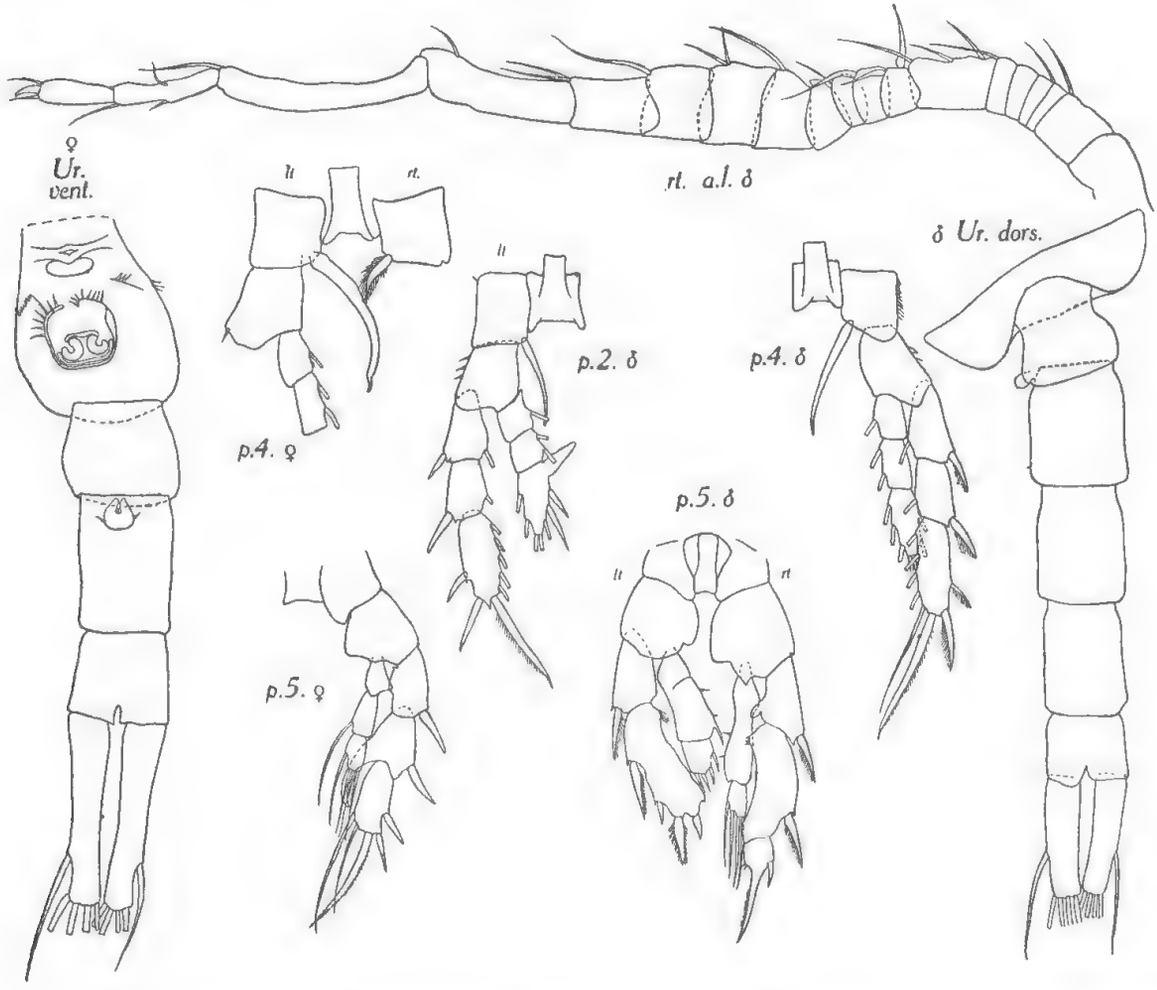

Fig. 1. ***Gladioferens inermis*** **sp. nov., male and female. The male first antenna is drawn from the under surface. All figures × 171.**

second legs the spur on the end segment of the left endopod is here more robust than it is in *gracilis,* which differs further in having the two adjacent inner setae unmodified. In *subsalaria* only the first of these setae is transformed into a spine. In the male urosome the asymmetry of the first segment, shown by Kiefer for *gracilis,* is also found here; in both sexes the last thoracic segment and urosome lack the spiny armature found in *gracilis.*

Genus BRUNELLA Smith 1909.

G. W. Smith, 1909, p. 87; Sars, 1912, p. 4.

According to Sars, who has given a full description of this genus, Smith has made a number of errors in his description of the type species, *B. tasmanica.* Thus

Sars asserts that there should be only three segments in the urosome in the female, in conformity with "all other fresh-water Calanoida"; the first antenna of the female should have only 25 segments; the exopod of the first leg should have three segments; and, finally, in Smith's description the right and left fifth legs of the male have been confused. The species found here and described below supports Sars' statements in every respect.

Seven species have been described in this genus(1), keys to both sexes of which are given below. Making allowance for the errors in Smith's description renders it difficult to separate *tasmanica* from *longicornis* Searle, which Sars described in full. He admits the similarity between the two species, and states that *longicornis* "is of smaller size and still more slender form of the body, differing moreover in the greater length of the anterior antennae." The females of these two species and of *steeli* are all very similar, the species being most easily distinguished by their respective males.

The occurrence of the present species from a salt lake appears to be the first occasion on which the genus has been recorded from any but fresh water.

KEY TO THE FEMALES.

1. Last thoracic segment with rounded postero-lateral corners .. .. .. 2.
   Last thoracic segment with pointed lateral projections, sometimes expanded into wings 5.
2. Fifth endopod 2-segmented .. .. 3.
   Fifth endopod 1-segmented .. .. *ampulla* Searle 1911.
3. Caudal rami not more than four times as long as wide .. *steeli* Henry 1924.
   Caudal rami at least five times as long as wide .. .. 4.
4. First antenna extending beyond caudal rami by its last three segments *longicornis* Searle 1912.
   First antenna scarcely reaching end of caudal rami .. .. *tasmanica* Smith 1909.
5. Fifth endopod 2-segmented .. .. 6.
   Fifth endopod 1-segmented .. .. *salina* sp. nov.
6. Second segment of fifth exopod with small outer process or spine opposite the large inner claw .. .. 7.
   This segment with outer distal corner rounded, unarmed .. *australis* Searle 1911.
7. End segment of fifth endopod with 1 inner and 4 sub-terminal setae *viridis* Searle 1911.
   End segment of fifth endopod with 2 inner, 2 terminal and 2 outer setae *expansa* Sars 1912.

It has not been deemed advisable to employ the three-segmented first exopod described for *steeli* in the construction of this key, as in the new species described here this exopod is three-segmented, but the segmentation is not very distinct. It is possible that this ramus is subject to variation particularly as the outer spines, which normally indicate the point of segmentation, are absent from this leg.

It is of interest to note that the outer spine is missing also from the proximal segment in all the legs. That the swimming legs are somewhat variable is shown by the variation in armature described for *salina (infra)*.

As far as can be ascertained all the species so far described have been taken from fresh water. This is the first record of a species occurring in a salt lake.

KEY TO THE MALES.

This key is based entirely on the structure of the fifth legs.

1. Right endopod 3-segmented .. .. 2.
   Right endopod 2-segmented .. .. 5.
   Right endopod 1-segmented .. .. *ampulla* Searle 1911.

(1) Since this account was written two more species have been described from Western Australia, by W. S. Fairbridge (*Journ. Roy. Soc., West. Aust.*, xxix, in press).

2.	Left exopod 3-segmented	*steeli* Henry 1924.
	Left exopod 2-segmented	3.
3.	End segment of left exopod as wide as long	4.
	End segment of left exopod twice as long as wide	*salina* sp. nov.
4.	Basal segment of left exopod twice as long as wide	*tasmanica* Smith 1909.
	Basal segment of left exopod once and one-half as long as wide ..	*longicornis* Searle 1912.
5.	Left endopod 2-segmented	6.
	Left endopod 1-segmented	*expansa* Sars 1912.
6.	Right endopod slender, end segment three times as long as wide, with 4 setae	*australis* Searle 1911.
	Right endopod stout, end segment as wide as long, with 8 setae ..	*viridis* Searle 1911.

Searle (1911) has followed Smith (1909) who has apparently confused the right and left fifth legs in the male. The long, curved, terminal claw is on the right leg, as shown by Henry (1924).

BRUNELLA SALINA SP. NOV.

Occurrence. VI. Many specimens of both sexes. Of the 100 specimens examined, representing about one-quarter of the total in the collection, 58 were females and 42 males. Some of the females had spermatophores attached but none was found carrying eggs; it is very probable that, as with most of the other members of this family, the eggs are liberated directly into the water. In this respect *Gladioferens* would appear to be an exception.

Female. Length 0·82 – 0·95 mm. The last thoracic segment is expanded into pointed, wing-like processes which are equally developed on both sides. That on the left, however, is somewhat more downturned than that on the right, giving an appearance of asymmetry. The urosome is 3-segmented, the genital segment having a prominent ventral protuberance; the caudal rami are a little more than twice as long as wide and about as long as the two preceding segments together. The first antenna is 25-segmented and reaches to the posterior end of the thorax. The remaining head appendages agree well with Sars' description of *longicornis* except for the mandible palp of which the exopod is relatively longer than in Searle's species, reaching slightly beyond the end of the elongate basis, and is apparently 4-segmented bearing 6 setae. The armature of the swimming legs appears to be subject to variation; the formula given below indicates what appears to be the normal condition, alike in both sexes:

	endopod.	exopod.
p.1.	320.	1.1.321.
p.2.	2.421.	1.1.421.
p.3.	2.421.	1.1.421.
p.4.	2.321.	1.1.421.

The following variations were found: the endopod of one of the first legs in a male had only two inner setae; the exopods of both first legs in a female had only two inner setae on the end segment; the endopod of one of the second legs in a female had only one inner seta on the basal segment; and the exopods of both third legs in a male had only three inner setae on the end segment.

In the armature of the swimming legs considerable differences are shown from the description of *longicornis* given by Sars. In view of the variation found in *salina* however, this may be unimportant.

The fifth legs have a 3-segmented exopod and 1-segmented endopod. The exopod is unarmed except for the inner spur or claw on the second segment, and two unequal spines on the end segment. The endopod shows small constrictions at the point of fusion of the segments, and is unarmed except for two small subequal terminal spines.

Male. Length 0·91 mm. The body differs from that of the female in several important characters. There is a pair of strongly refractive corneal lenses at the front of the head, which are absent from the female, and the last thoracic segment lacks the wing-like processes of the female. This segment has slightly pro-

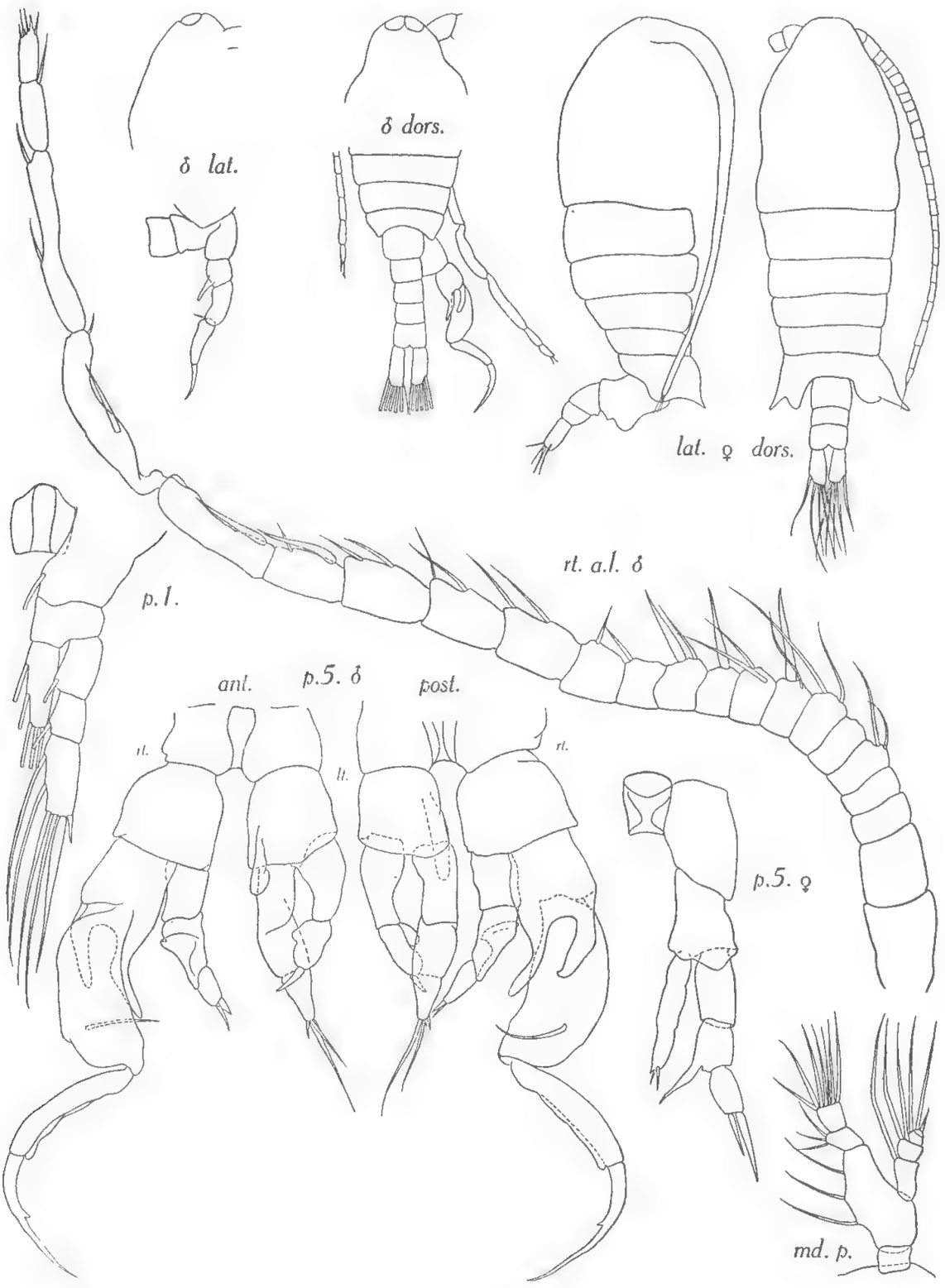

Fig. 2. *Brunella salina* sp. nov., male and female. The male first antenna is drawn from the under surface. Separate appendages × 200; other figures × 67.

jecting posterior corners, which are rounded and unarmed. The right first antenna is considerably longer than the left (which resembles that of the female) extending nearly to the end of the caudal rami, though having only 22 segments.

The complicated fifth leg approaches in its structure most closely to those of *tasmanica* and *longicornis,* but has a much more slender left exopod. The structure of this leg is illustrated from both anterior and posterior surfaces, and its appearance from the right side is also shown. The right exopod is very long, and when extended reaches beyond the caudal rami.

In the female this species is very like *expansa* in its general shape, though the posterior thoracic processes are directed outwards more strongly than in that species and the body is not so slender. The fifth legs in both sexes are quite distinct from Sars' species.

FAMILY PSEUDODIAPTOMIDAE Sars 1902.

Sars, 1902, p. 73.

The family was created by Sars, without definition, for two genera, *Pseudodiaptomus* and *Poppella,* which "together form a natural group somewhat intermediate between the Diaptomidae and the Temoridae." This arrangement was followed by A. Scott (1909) and by Früchtl (1924) but both Sewell (1924, 1932) and Wilson (1932) include *Pseudodiaptomus* in the Diaptomidae.

Genus PSEUDODIAPTOMUS Herrick 1884.

Scott, A., 1909, p. 116; Wilson, 1932, p. 101.

The systematics of this genus, which includes numerous species ranging from purely fresh water to marine conditions, have been discussed by Sewell (1924, p. 784; 1932, p. 233) and by Brehm (1924, p. 84). The latter gives a key which includes most of the species. Sewell (1924) suggested a division of the species into two groups, dependent upon the relative length of the terminal spines on the fifth leg of the female. In one group these spines are sub-equal and comparatively short, while in the second group at least one of these spines is "nearly equal in length to the whole limb".

The species found here comes into the first group and is very close to *salinus* Giesbrecht (1896), which has been recorded from the Mediterranean to the Indian Ocean, but differs in several respects, particularly in the male. The tendency for the species of this genus to have a very localized distribution, particularly where the conditions are less saline, justifies this species in being regarded as distinct from the marine form with its wide distribution.

The salinity at Blanche Harbour, where this form was taken, is presumably lower than that of ordinary sea water, judging by the presence of *Gladioferens* in the same collection.

PSEUDODIAPTOMUS CORNUTUS sp. nov.

Occurrence. III, 16 females (2 ovigerous), 11 males, 5 young.

Female. Length 1·20 – 1·24 mm. Body symmetrical, head fused with first segment, the latter bearing a pair of rounded knobs dorso-laterally on the posterior margin. The fourth and fifth segments are fused, and the posterior corners produced into spine-like processes extending beyond the middle of the genital segment. The urosome is 4-segmented, the genital segment being the longest and having a ventral swelling. There is a group of spinules laterally on the left side of this segment. The caudal rami are three times as long as wide. The first

antennae extend to the posterior margin of the genital segment. The fifth legs are very like those of *salinus*, as illustrated by Thompson & Scott (1903, pl. ii, fig. 21) but the basal segment of the 2-segmented exopod (there is no endopod) is more elongate and has the inner distal corner extended into a triangular projection. The outer of the two large terminal spines has the small middle spine fused with it at the base.

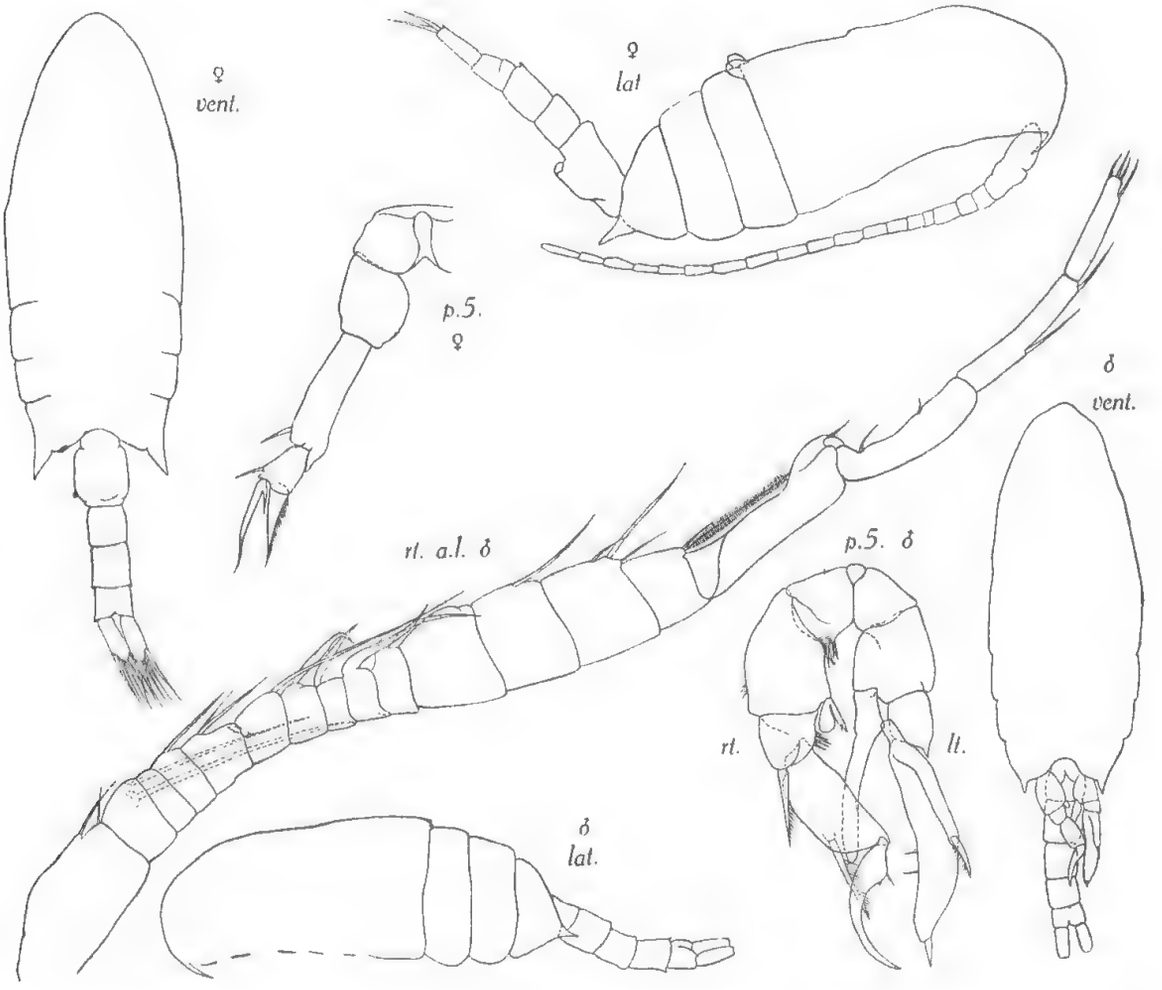

Fig. 3. *Pseudodiaptomus cornutus* sp. nov. Male and female × 57; appendages × 171.

Male. Length 0·93 – 1·04 mm. Body as in the female but the dorso-lateral knobs on the first segment are less pronounced when seen in lateral view than in the female. The urosome is 5-segmented and the caudal rami are similar to those of the female. The right first antenna is composed of 18 segments and reaches to the posterior margin of the second segment of the urosome. The fifth legs in the extended position reach to the middle of the fourth segment of the urosome. These legs show certain differences in proportions and armature from those of *salinus*, as shown by Thompson & Scott (*op. cit.* pl. ii, fig. 22). The coxa of the right leg bears two bifid spines set on small prominences at its inner distal corner, not shown for *salinus*, and the right endopod has the outer lamelliform plate wider than in Giesbrecht's species. The terminal segment of this exopod is here modified into a long curved claw reaching beyond the end of the left leg. The distal segment of the left exopod is more slender than in *salinus* and has a rounded

proximal extension directed towards the base of the leg. The outer spine is inserted at approximately the middle of the margin and the segment is rounded terminally, bearing a short spine.

The male of *salinus*, first described by Thompson and Scott *(loc. cit)* is of the same size as the female. In the species found here the male is distinctly smaller. Both sexes are further distinguished from *salinus* by the knob-like projections on the cephalic segment.

FAMILY PSEUDOCYCLOPIDAE Giesbrecht 1893.

Giesbrecht and Schmeil, 1898, p. 125; Sars, 1902, p. 129.

Genus PSEUDOCYCLOPS Brady 1872.

Giesbrecht and Schmeil, 1898, p. 125; Sars, 1902, p. 130.

Six species have already been described as belonging to this genus, though males are known for only four. The female of a seventh is described and keys for the identification of the species are given below. It is not practicable to include Esterly's (1911) species *magnus* in the key as the description is very brief and the figures very few; unfortunately also, the male is unknown.

Despite the difference in size there is a strong probability that *magnus* (1·1 mm.) and *latens* (0·63 mm.) are identical. The fifth legs of the female are figured in both cases and show a strong resemblance, differing chiefly in the absence in *magnus* of the spinules surrounding the bases of two of the terminal spines of the exopod shown for *latens*.

This leg in these species is quite different from those of other species, being characterized by the partial or apparent fusion between the first and second segments of the endopod, both of which are unarmed, and the second segment being widened and extended into spurs on both sides distally so that the small terminal segment appears to be sunk into a recess. The end segment is produced into a spur at the outer distal corner and bears a small adjacent terminal seta, the inner corner being produced into a very small point. From the two descriptions and figures there is no reason for separating them as species and their occurrence lends further support since it has been shown that the Bermudan fauna is closely related to that of the Suez Canal zone (Willey, 1930, pp. 82, 113). In the event of this synonymy being established Gurney's name will, of course, have to give way to Esterly's.

KEY TO THE FEMALES OF PSEUDOCYCLOPS.

1. Two or more segments of the fifth endopod fused .. .. 2.
   Segmentation of this endopod distinct .. .. 3.
2. Second and third segments of fifth endopod fused, end segment of exopod with 2 inner setae; first antenna 15-segmented .. .. *umbratilus* Giesbrecht 1893.
   All three segments of fifth endopod fused, end segment of exopod with 1 seta and 3 short spinules; first antenna 17-segmented .. .. .. *crassiremis* Brady 1872.
3. Caudal rami much wider than long, overlapping in mid-line .. *latens* Gurney 1927
   Caudal rami at least as long as wide, separated .. .. 4.
4. Fifth endopod with first and second segments produced into sharp processes at the outer distal corners .. .. 5.
   Only the second segment so produced .. .. *obtusatus* Brady and Robertson 1873.
5. Endopod of second antenna 2-segmented; caudal rami longer than wide, parallel; first antenna 17-segmented .. .. *simplex* Sewell 1932.
   Endopod of second antenna 3-segmented; caudal rami no longer than wide, divergent; first antenna 18-segmented .. .. *australis* sp. nov.

KEY TO THE MALES.

1. Endopod of right fifth leg a rounded or rectangular plate .. .. .. 2.
   This endopod short, tapering to a sharp point .. .. *crassiremis* Brady 1872.
   This endopod elongate, slender, distally curved inwards .. *simplex* Sewell 1932.
2. This endopod rounded, unarmed, articulating with the basipod *umbraticus* Giesbrecht 1893.
   This endopod sub-rectangular, truncate, bearing a short triangular spine on its posterior surface, and completely fused with the basipod .. *obtusatus* Brady and Robertson 1873.

The details for the species *obtusatus* and *crassiremis* used in these keys were obtained from Sars 1902 and 1921 respectively.

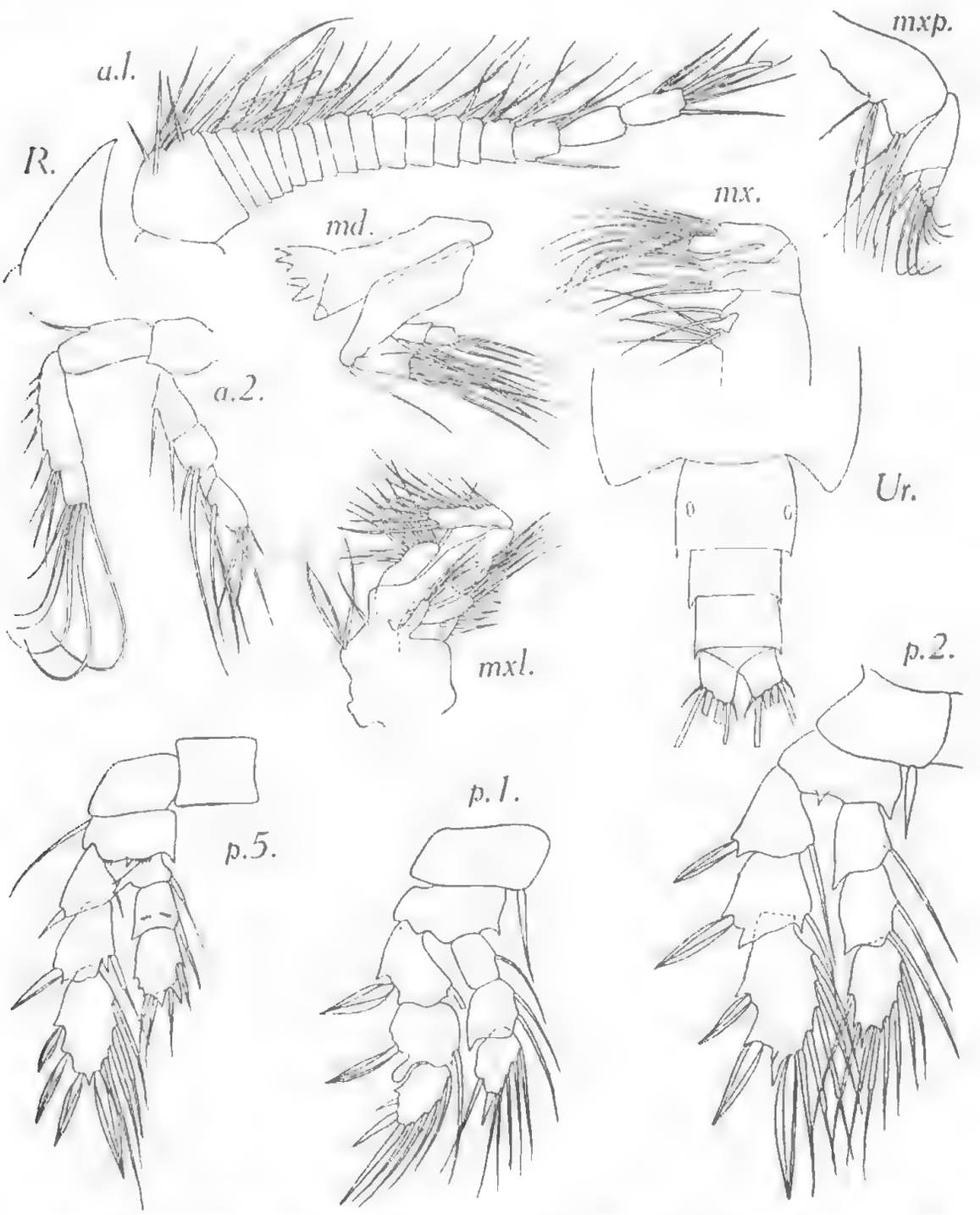

Fig. 4. *Pseudocyclops australis* sp. nov., female. Urosome × 160; appendages × 265.

PSEUDOCYCLOPS AUSTRALIS sp. nov.

Occurrence. XIII, 1 female, 1 juvenile.

Female. Length 0·78 mm. The body is of similar proportions to *obtusatus;* the urosome is 4-segmented, the anal segment being very short and partly telescoped into the pre-anal; the caudal rami are as long as wide, and somewhat divergent. The first antenna has eighteen segments and the second antenna has the end portion distinctly cut off as a separate segment. The mouth parts are much as in *obtusatus.* The middle segment of the endopod of the first leg has an elongate bulbous process distal to the outer spine. In the fifth leg both the first and second segments of the endopod have their outer distal corners produced into processes, that on the first segment being very pronounced and bearing a small seta; the end segment has several distal processes, two of which are large, and bears four setae. The seta formula is as follows:

	endopod.	exopod.
p.1.	1.2.321.	1.1.412.
p.2.	1.2.422.	1.1.512.
p.3.	1.2.422.	1.1.513.
p.4.	1.2.322.	1.1.513.
p.5.	1.1.220.	1.1.413.

The species is not unlike *simplex* but differs in the armature of the swimming legs and in the caudal rami.

FAMILY PONTELLIDAE Giesbrecht 1892.

Giesbrecht and Schmeil, 1898, p. 131; Sars, 1902, p. 137.

Genus CALANOPIA Dana 1852.

Giesbrecht and Schmeil, 1898, p. 131; A. Scott, 1909, p. 175.

CALANOPIA THOMPSONI A. Scott

A. Scott, 1909, p. 178; Sewell, 1932, p. 342.

Occurrence. I, 3 females, 1 male; II, 7 females, 5 males, 2 juveniles; III, 1 female; IV, 8 females, 4 males; V, 2 juveniles ?; VII, 1 female; IX, 1 female; XIV, 2 females, 1 male.

Distribution. Malay Archipelago, Southern Burma, Ceylon Pearl Banks, "Investigator" Stations 587, 614.

With the exception of the "Investigator" collections all of the places where this species has been taken are coastal, usually quite close to the shore, often having been taken while the vessel was at anchor. In the case of the exceptions mentioned I have been unable to trace the localities of these stations, but from the remarks made by Sewell (1929, p. 2) it would appear at least probable that these stations fall into line with the above. The species must, therefore, be regarded as a coastal form and it is interesting to find it in the present collections, which are all taken from the western shores of South Australia. Furthermore, although the genus is represented in the waters of New South Wales (Dakin and Colefax, 1940, p. 105) this species has not been recorded from that region.

Genus LABIDOCERA Lubbock 1853.

Giesbrecht and Schmeil, 1898, p. 132; Sars, 1902, p. 141.

LABIDOCERA CERVI Kramer 1895.

Kramer, 1895, p. 218; Brady, 1899. p. 37; Farran, 1929, p. 275; Dakin and Colefax, 1940, p. 101.

Occurrence. II, 1 female (2·60 mm.); IV, 1 male (2·95 mm.); V, 1 male (2·42 mm.).

Distribution. Coastal waters of northern New Zealand, and of southern and eastern Australia.

In the female found here the abdomen was distinctly three-segmented as pointed out by Dakin and Colefax; the male and female fifth legs agree well with those figures by these authors (fig. 148 d, f).

LABIDOCERA CAUDATA sp. nov.

Occurrence. V, 2 females.

Female. Length 2·24 mm. The head is rounded and without crest or side hooks; the urosome appears to be 2-segmented but is so completely enveloped by the spermatophore that its segmentation is somewhat obscured. The asymmetry

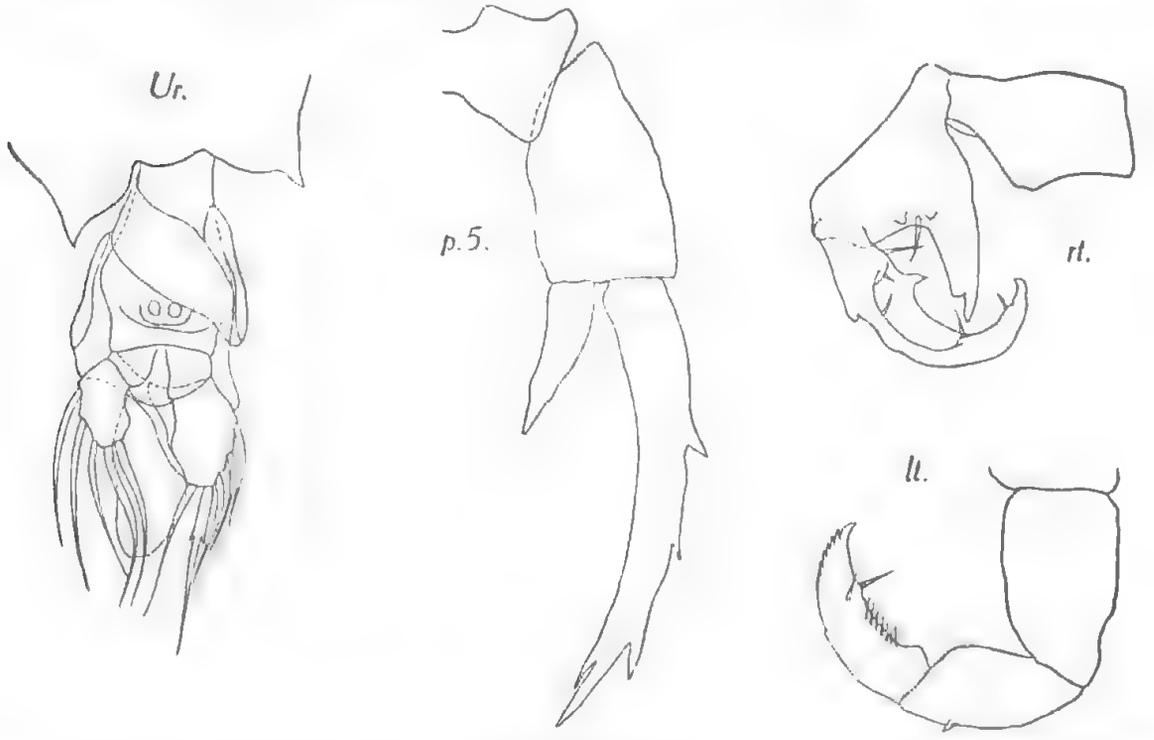

Fig. 5. ***Labidocera caudata*** **sp. nov., female. Urosome × 69; fifth leg × 206.** ***Tortanus barbatus*** **(Brady), male fifth legs × 206.**

shown by the caudal rami is unusual in that the left ramus is larger than the right; there is no lateral outgrowth on the genital segment, which is slightly swollen ventrally. The fifth thoracic segment ends in lateral points which are also symmetrical. The fifth legs have a comparatively large endopod, reaching as far as the first outer spine of the exopod. The spines on the exopod are none of them very large except the terminal spine which is long and sharply pointed.

This species clearly cannot be identified with that described as sp. (nov.?) by Dakin and Colefax, but approaches most closely to *gangetica* Sewell (1934). I have been unable to compare it with *rotunda* Mori (1929) and *japonica* Mori (1935) as the publication in which the descriptions have appeared is not available in Australia.

FAMILY TORTANIDAE Sars 1902.

Sars, 1902, p. 73.

This family was one of those created by Sars without definition to include the two genera *Tortanus* and *Mormonilla*, but A. Scott (1909) places the latter in a separate family.

Genus TORTANUS Giesbrecht 1898.

Giesbrecht and Schmeil, 1898, p. 157; Steuer, 1926; Sewell, 1923, p. 398.

The latest revision of this genus, by Sewell, divides it into two subgenera, *Tortanus* and *Atortus*.

TORTANUS (TORTANUS) BARBATUS (Brady).

Brady, 1883, p. 71 (*Corynura*); Sewell, 1932, p. 399.

Occurrence. II, 1 female, 1 male; III, 2 females, 1 juvenile; V, 1 female.

Distribution. Indo-pacific and Malayan regions.

This species has been recorded from the coastal waters of New South Wales by Dakin and Colefax (1940) who state (p. 106) that they were unable to discover any description of the male in the available literature. From Steuer's (1926) revision of the genus, to which these authors did not have access, it appears that Früchtl (1924) has described the male. Steuer himself described it from fresh material and, although his figure of the fifth legs is not very clear, the structure of the caudal rami and the smaller size make it almost certain that the male found here is that of Brady's species. At the same time, the fifth legs of the male figured by Dakin and Colefax (*loc. cit.*, p. 104, fig. 161 c) agree closely with those found in this specimen. The caudal rami are also similar and the probability is, therefore, that despite the difference in size of their specimen it should be identified as the male of *barbatus*. Unfortunately in the single male at my disposal the right antenna was broken off close to the base. Früchtl's illustration (fig. 42) of the male fifth legs agrees in structure with that given here (fig. 5) but he does not show the full armature on the left leg.

CYCLOPOIDA.

In attempting the description of the Cyclopoids in this collection I have followed Sars' system of classification. This was completed in 1918, and does not appear to have been modified to any serious extent since that time. Sars divides the group into three Sections according to the structure of the mouth parts. The characteristic features may conveniently be summarized in the form of a key:

1. Second antenna with an exopod (usually); mouth parts suctorial; maxillae and maxillipeds sub-chelate .. .. SIPHONOSTOMA (II).
   Second antenna without an exopod; mouth parts non-suctorial; maxillae never sub-chelate (maxillipeds sometimes in male) .. .. 2.
2. Second antenna non-prehensile; mouth parts masticatory; first antennae hinged in male GNATHOSTOMA (I).
   Second antenna usually prehensile; mouth parts non-masticatory; first antenna in male not hinged .. .. POECILOSTOMA (III).

Apart from two species of *Oithona*, normal constituents of the plankton, no members of Section I were found. It is somewhat surprising that no Cyclopinidae were found, since these are littoral forms, but further search will probably reveal representatives of this family.

GNATHOSTOMA.

FAMILY OITHONIDAE Sars. 1913.

Genus OITHONA Baird 1843.

Sars, 1913, p. 4; Rosendorn, 1917.

OITHONA NANA Giesbrecht 1892.

Sars (1913, p. 5) suggests that this species should constitute the type of a new genus, *Oithonina*. This was not accepted by Rosendorn (1917) but Wilson (1932) uses Sars' generic name for this species. I have followed Rosendorn, who regards *nana* as the type of a group of species within the genus *Oithona*.

Occurrence. III, several females (0·52 - 0·72 mm.).

Distribution. Widely distributed in the warmer regions, also found in the North Sea. The species has not, apparently, previously been recorded from Australian waters.

OITHONA ATTENUATA Farran 1913.

Occurrence. III, several females (0·50 mm.).

Distribution. Chiefly Indo-pacific; recorded also from the Atlantic (Rosendorn). This species has previously been recorded from Australian coastal waters by Farran (1936).

SIPHONOSTOMA.

The bulk of this collection comprises chiefly those copepods peculiarly adapted for a semi-parasitic existence, for which they are provided with suctorial mouth parts. This interesting group has been divided by Sars into a number of families, all but one of which are represented here. Their more important distinguishing characters can again best be summarized in the form of a key:

KEY TO THE FAMILIES.

1. Second antenna non-prehensile .. .. 2.
   Second antenna strongly prehensile .. .. .. CANCERILLIDAE Sars 1915.
2. Fourth legs present .. .. 3.
   Fourth legs absent .. .. ARTOTROGIDAE Sars 1915.
3. Body expanded, with well developed epimera; genital segment widened anteriorly; fifth legs reduced to a knob-like process; fourth endopod usually reduced or absent (in a few cases normal) .. .. DYSPONTIIDAE Sars 1915.
   Body more or less slender, usually without epimera; genital segment only slightly widened anteriorly; fifth legs 2-segmented, though proximal segment not always clearly defined; fourth endopod always well developed .. .. 4.
4. Sensory filament of first antenna on terminal segment; mandible without palp MYZOPONTIIDAE Sars 1915.
   Sensory filament of first antenna sub-terminal; mandible palp present .. .. 5.
5. Second antenna as long as first, its exopod as long as the third segment; siphon reaching at least to genital segment, usually to caudal rami .. ACONTIOPHORIDAE Sars 1915.
   Second antenna much shorter than first, its exopod shorter than the third segment; siphon much shorter, sometimes absent .. ASTEROCHERIDAE Giesbrecht 1899, sens. str.

As will be seen, the Dyspontiidae are somewhat difficult to define as a family, and to separate from the others. Hansen (1923, p. 2) retains Giesbrecht's Asterocheridae in its widest sense and disagrees with Sars' division of that family into smaller families. With the possible exception of the Dyspontiidae it appears that

Sars' families are well defined. In this family, while the typical forms show a first antenna with reduced segmentation and the fourth endopod reduced or absent, in some forms this leg is normal and the first antenna has a greater number of segments and does not show the fusion of segments between the second and eighth so characteristic of the majority of the genera.

These few exceptional genera nevertheless show the expanded body with well-developed epimera and have the female genital segment greatly expanded in its anterior half. These two features are, therefore, regarded as characteristic of the family, and those genera which do not show the reduction in the first antenna and fourth leg, but are otherwise typical, are regarded as intermediate between the Asterocheridae and Dyspontiidae.

FAMILY ASTEROCHERIDAE Giesbrecht sens. str.

syn. Ascomyzontidae Sars, 1915, p. 83.

Sars *(op. cit.,* p. 85) discards Boeck's name *Asterocheres* in favor of Thorell's *Ascomyzon,* although he admits it has priority, because "the species of this genus are by no means exclusively parasites of Asterids". Boeck's name must, however, stand on rules of priority and has been accepted by recent authors.

Thorell (1859) used the name Ascomyzontidae to designate a family which is apparently equivalent to the Asterocheridae of Giesbrecht (1899) since the latter author had previously (1895, 1897) used Thorell's name, and in 1899 (p. 67) place this name as a synonym of his new name.

Giesbrecht divided his family into sub-families, which Sars (1915) raised to family status, and further subdivided, but reverted to the name Ascomyzontidae, used in a restricted sense, equivalent to Giesbrecht's sub-family Asterocherinae from which he removed the genus *Acontiophorus* as the type of a new family.

As stated above, I have followed Sars' classification, but since the genus *Ascomyzon* no longer exists it cannot be used for the family name. I have, therefore, substituted Giesbrecht's Asterocheridae, used in the restricted sense equivalent to Sars' Ascomyzontidae.

One genus of this family was found here and a new genus, which approaches *Dermatomyzon,* is described.

AUSTRALOMYZON gen. nov.

The genus is defined by the following combination of characters: Body comparatively slender, with little or no development of epimeral plates; urosome 4-segmented in the female, 5-segmented in the male; first antenna with the segmentation of the proximal region distinct; second antenna 4-segmented, with a reduced exopod attached to the second segment; oral cone produced into a siphon, reaching to the first legs; rami of the first four pairs of legs 3-segmented.

The genus is intermediate between *Dermatomyzon* and *Rhynchomyzon,* resembling the latter in general appearance, having posterior projections on the metasome segments, and the former in having similar projections on the urosome segments. It resembles both of these genera in the segmentation of the urosome and differs from both in the presence of a well developed siphon.

AUSTRALOMYZON TYPICUS sp. nov.

Occurrence. IX, 1 male; XI, 2 females.

Female. Length 1·20 mm. Anterior body ovoid, rounded in front, with a small rostrum directed postero-ventrally. The first segment is fused with the head, the second and third have postero-lateral projections, and the fourth seg-

ment is very small; the fifth segment is expanded laterally and bears the one-segmented fifth legs. The genital segment is nearly as long as the three posterior segments and not greatly expanded anteriorly. This and the following segment

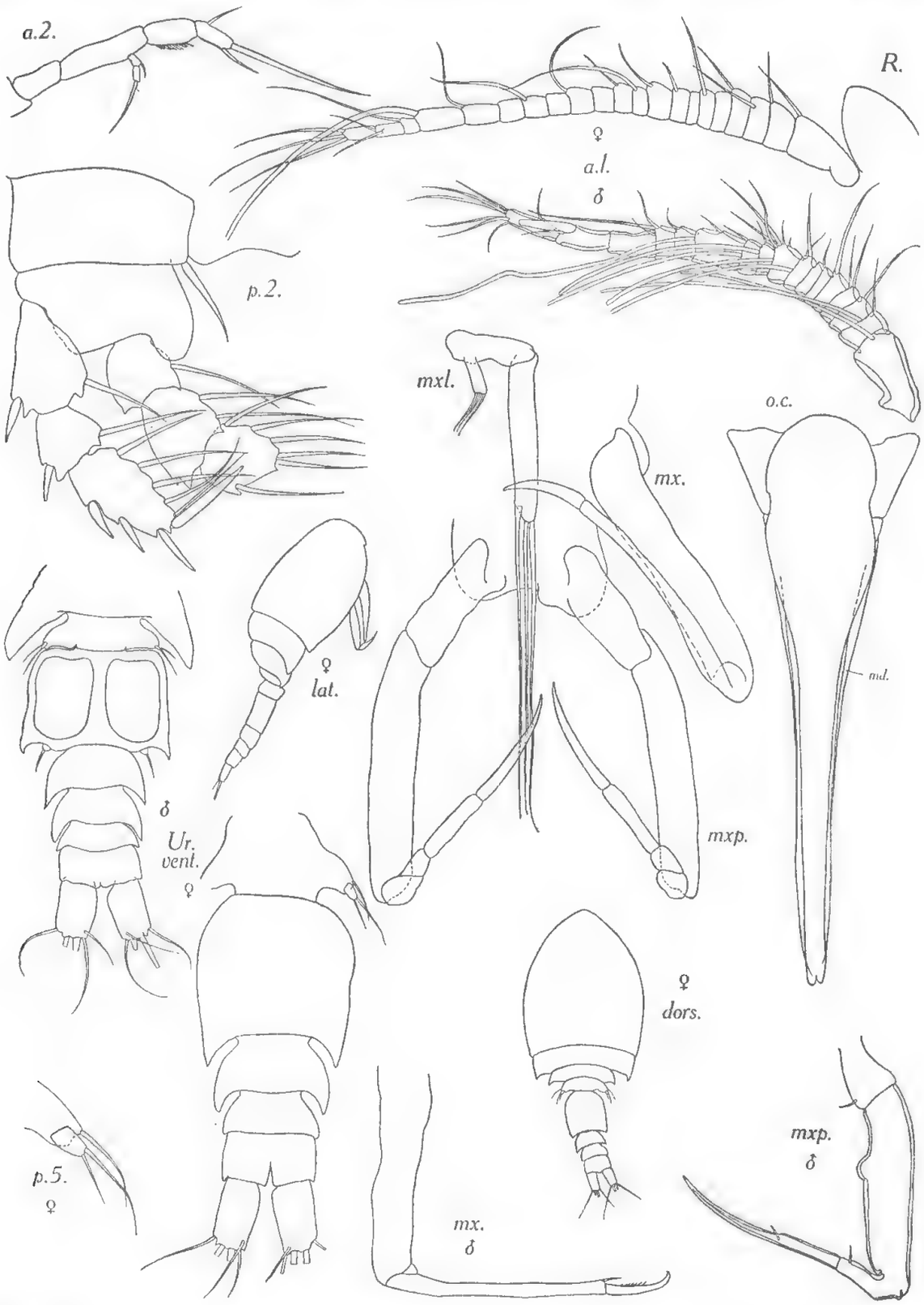

Fig. 6. *Australomyzon typicus* gen. et sp. nov., male and female. Female × 29; urosome, both sexes, × 110; appendages × 183.

have postero-lateral projections, similar to those of the thoracic segments. The caudal rami are about twice as long as wide, and half as long again as the anal segment.

The first antenna is 21-segmented, having the sensory filament on the eighteenth; the second antenna is 4-segmented, with a 2-segmented exopod attached to the outer distal margin of the second segment. The oral cone is wide basally, tapering gradually, stoutly constructed and reaches only to the base of the first legs. The mandible palp is thin and as long as the siphon. The maxillule has a small outer lobe, bearing three short setae, and a long inner lobe also with three setae, which are long. The maxilla and maxilliped are of comparatively slender structure. The swimming legs are strongly built, and all of the same general structure. Seta formula:

	endopod.	exopod.
p.1.	1.2.321.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	1.2.221.	1.1.423.

Of these, in addition to the outer spines of the exopods, the outer terminal appendage of the exopod in all legs, and the inner terminal appendage of the third and fourth endopods is a spine. There are no spines on the first and second endopods. The fifth legs are one-segmented appendages bearing two terminal setae; the basal segment is fused with the fifth segment and bears one seta. The caudal rami each bear one distal lateral seta, one dorsal and three terminal setae.

Male. Length 1·02 mm. This differs from the female in a few characters. The urosome is 5-segmented; the genital segment is rectangular in shape and this and the three following segments have postero-lateral projections. The anal segment is relatively slightly shorter than that of the female. The first antenna is 17-segmented, the last three segments being fused. In addition to the large subterminal sensory filament there are a few more slender filaments attached one to each of segments 1, 2, 8, 9, 10, 11 and 12. The maxilla and maxilliped are more slender than in the female. The armature of the swimming legs is identical with that of the female; the fifth legs are similar but smaller, and sixth legs are present as small knobs on the posterior margins of the genital segment.

Genus SCOTTOCHERES Giesbrecht.

Giesbrecht, 1897, p. 18; Sars, 1915, p. 106.

The genus was established by Giesbrecht for a species wrongly assigned to *Acontiophorus* by T. & A. Scott (1894: *A. elongatus*); at the same time he described a second species, *S. longifurca*. In 1902 he described *S. stylifer;* a fourth species, *S. gracilis*, being subsequently described by Hansen (1923).

SCOTTOCHERES LATUS sp. nov.

Occurrence. IX, 1 female.

Female. Length 0·91 mm. The body is very rounded anteriorly, its width being nearly equal to the length of the head and first free segment together. The urosome is 3-segmented, the genital segment forming half of the total length of the urosome and is slightly expanded anteriorly, without lateral teeth, but has a bunch of setae on each side distal to the centre; the second and third segments are sub-equal. The caudal rami are subrectangular and about half of the anal segment.

The first antenna is 19-segmented, distinctly divided into two regions, the proximal 9-segmented portion having short, wide segments, the distal portion

having the segments elongate; the sensory filament is borne on the 17th segment. The second antenna has a short basal segment, a long second segment bearing the one-segmented exopod, a longer and more slender third segment, and a short end

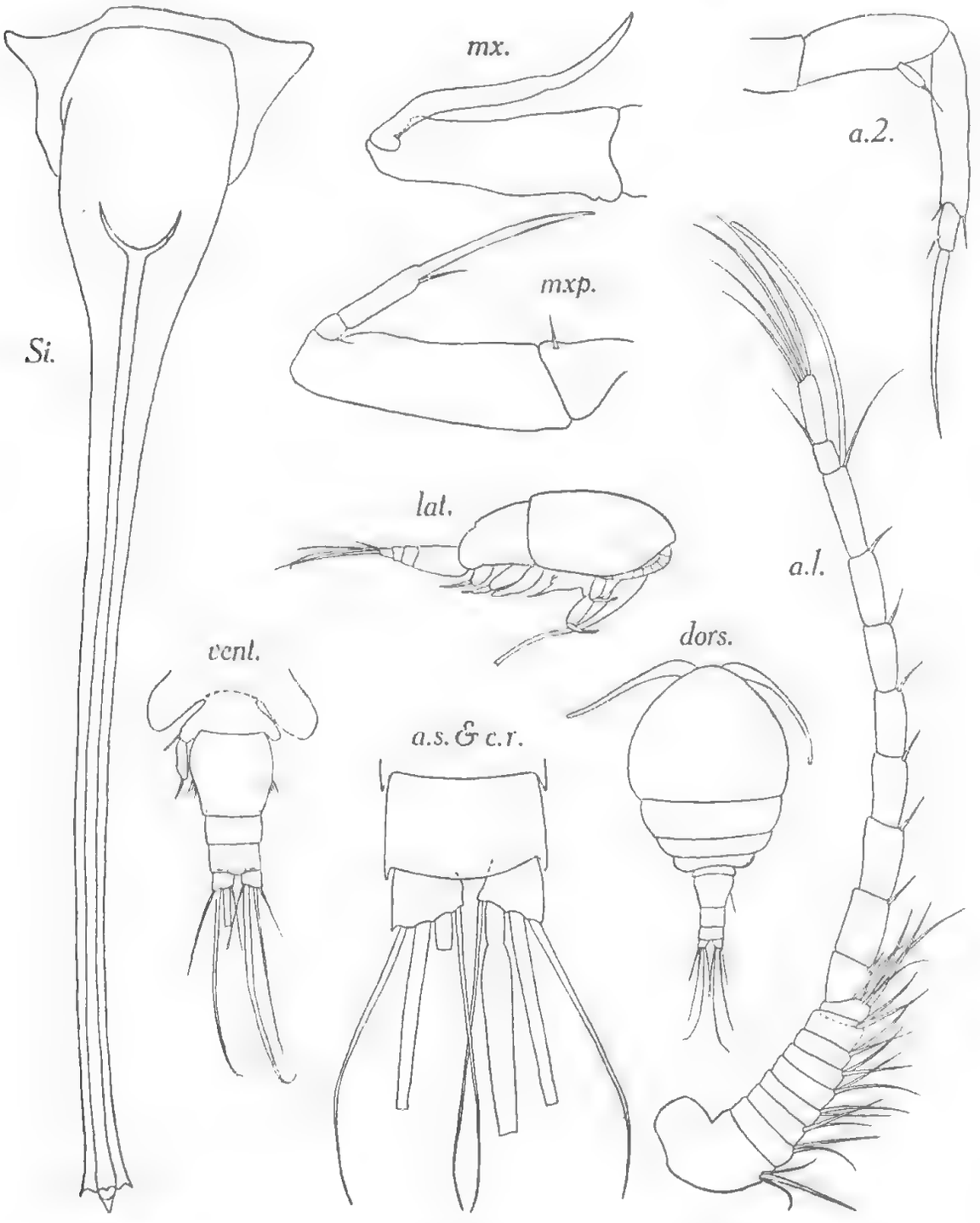

Fig. 7. *Scottocheres latus* sp. nov. Female ×38; urosome × 80; appendages × 240.

segment bearing a single large terminal spine and a short lateral seta. The siphon is long and slender, reaching to the posterior end of the metasome. The maxillule has a short outer lobe bearing one short and two long setae, and a long inner lobe similarly armed, though the setae are longer; it is like that of *elongatus* (as

shown by Sars, 1915). The maxilla and maxilliped are of stouter construction than in that species and the division of the terminal portion into segments is indistinct. The swimming legs are as in *elongatus*, with the following seta formula:

	endopod.	exopod.
p.1.	1.2.321.	1.1.223.
p.2.	1.2.321.	1.1.323.
p.3.	1.2.321.	1.1.323.
p.4.	1.2.221.	1.1.323.

This differs from *elongatus* in that the first endopod has two inner setae on the middle segment and both rami of the third and fourth legs have each a terminal seta and spine, as in the third endopod of *elongatus*. The fifth legs are elongate, with a single distal seta. The caudal rami have four terminal setae.

I have not been able to see a description of *S. stylifer*, but the present species differs from the others in having the anterior body considerably dilated, the genital segment as wide as long, rounded and without lateral teeth, the second and third segments of the urosome sub-equal, the terminal segment of the first antenna divided, the maxilla and maxilliped comparatively more robust, and the fifth leg extending to beyond the middle of the genital segment. It resembles *S. longifurca* in having the third and fourth segments of the first antenna separate and, as in *elongatus*, the caudal rami are sub-rectangular and about half as long as the anal segment.

FAMILY ACONTIOPHORIDAE Sars.

Sars, 1915, p. 109.

This monogeneric family was established by Sars (1915) for a genus which departed in several respects from the typical Asterocheridae.

Genus ACONTIOPHORUS Brady.

Brady, 1880, pp. 23, 69; Giesbrecht, 1897, p. 18; Sars, 1915, p. 110.

The name was first used by Brady *(loc. cit.)* in place of *Solenostoma* Brady and Robertson (1873), which was preoccupied. There are three species: *scutatus* (Brady and Robertson) 1873, syn. *angulatus* I. C. Thompson 1888; *ornatus* (Brady and Robertson) 1875, syn. *armatus* Brady, 1880; and *antennatus* Hansen, 1923. *A. elongatus* T. and A. Scott (1894) was made the type of Giesbrecht's new genus *Scottocheres (supra)*. A fourth species is described here.

KEY TO THE SPECIES OF ACONTIOPHORUS.

1. End segments of second antenna sub-equal .. .. 2.
   Distal segment twice as long as penultimate .. .. *antennatus* Hansen 1923.
2. Exopod of second antenna no longer than penultimate segment *ornatus* (Brady and Robertson) 1875.
   Exopod of second antenna longer than this segment .. .. 3.
3. Exopod of second antenna not reaching the middle of the terminal segment; caudal rami three times as long as wide .. .. *scutatus* (Brady and Robertson) 1873.
   Exopod of second antenna reaching beyond the middle of the terminal segment; caudal rami twice as long as wide .. .. *zealandicus* sp. nov.

ACONTIOPHORUS ZEALANDICUS sp. nov.

syn. *A. scutatus* (Brady and Robertson) G. M. Thomson, 1883.

Occurrence. IX, 1 female; XI, 3 females, 1 male; XII, 1 female.
Distribution. Otago Harbour, New Zealand.

Female. Length 0·95 - 1·04 mm. The body has the usual rounded shape of the genus, but the genital and pre-anal segments have posterior projections at their hinder ends. There is a well developed, pointed rostrum. The first antenna is 11-segmented, with a sensory filament on the eighth segment; the second antenna has a long exopod, extending to beyond the middle of the end segment.

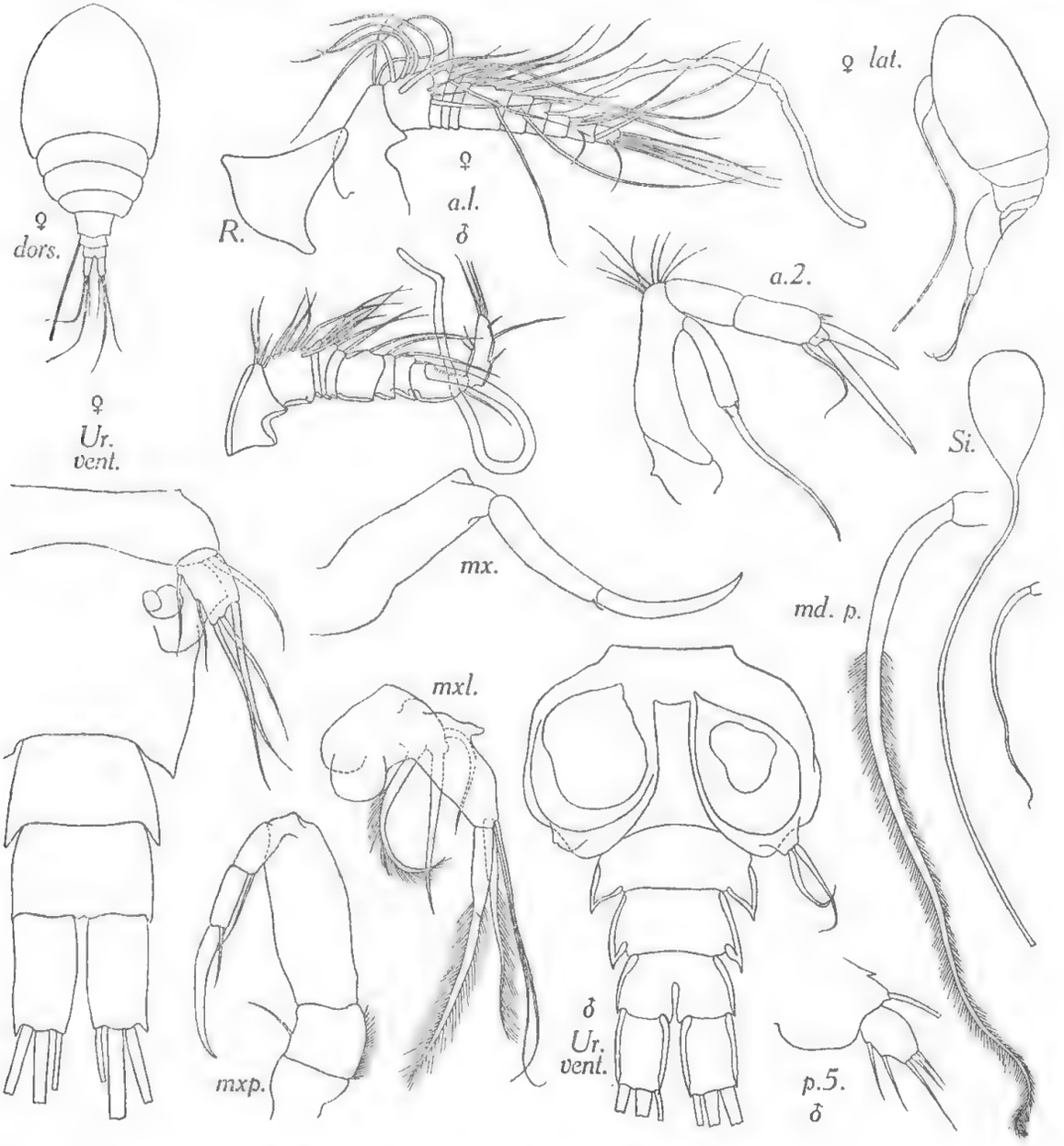

Fig. 8. *Acontiophorus zealandicus* sp. nov., male and female. Female × 32; urosome, both sexes, and siphon × 67; appendages × 200. The mandible palp is shown also at the same magnification as the siphon for comparison.

The siphon is very long, extending well beyond the caudal rami, almost reaching to the end of the caudal setae. The mandible palp is a long delicate seta, densely plumose for the greater part of its length. The maxillule has a short outer lobe with three setae, one of which is plumose, and a longer inner lobe with four setae, two of which are stouter than the others and plumose. The maxilla and maxilliped do not show any specific differences. The swimming legs are armed in a manner similar to those of *scutatus* (cf. Sars, 1915). The seta formula is as follows:

	endopod.	exopod.
p.1.	1,2,321.	1,1,323.
p.2.	1,2,321.	1,1,413.
p.3.	1,2,311.	1,1,313.
p.4.	1,2,211.	1,1,313.

The fifth legs are each represented by a well-developed, sub-rectangular segment bearing three terminal and two inner marginal setae; there is a single seta representing the basal segment which is fused with the corresponding body segment. The caudal rami are twice as long as wide and a little longer than the anal segment and armed with three terminal setae, the innermost of which is short and much more slender than the other two.

Male. Length 0·87 mm. The body is similar to that of the female; the urosome is 4-segmented with the three posterior segments sub-equal; the caudal rami are scarcely twice as long as wide. The first antenna is 10-segmented, having the third, fourth and fifth segments together scarcely more than half as long as the sixth, and the terminal segment distinctly hinged upon the preceding segment. In the second antenna the exopod extends to beyond the middle of the terminal segment, as in the female. There is little else to distinguish this from the female and it differs from the male of *scutatus* by the same features which separated the respective females, in addition to which the first antenna has only ten distinct segments compared with eleven in *scutatus*.

Thomson (1883, p. 115) states that the species found by him in Otago Bay "conforms exactly" with Brady's description of *scutatus*, which he quotes in full. Hansen (1923, p. 11) remarks in this connexion that Thomson is "most probably wrong." Hansen would appear to be correct here since the species found here, while closely resembling *scutatus*, differs from it in several respects in each of which, where comparison can be made. Thomson's figures show a similar difference. These differences are: in the first antenna in *scutatus* the third, fourth and fifth segments together equal the sixth; in *zealandicus* the sixth segment is considerably greater than these three together; in the second antenna of *scutatus* the exopod does not reach the middle of the terminal segment, whereas in *zealandicus* it extends beyond the middle; the caudal rami are more slender in *scutatus* (length/width: 3/1), in *zealandicus* this ratio is only 2/1. Thomson's figure shows the urosome somewhat upturned so that here no comparison can be made.

In view of these differences it seems probable that Thomson's specimen is identical with the new species described here.

FAMILY MYZOPONTIIDAE Sars.

Sars, 1915, p. 112.

This family was constituted by Sars for two genera which Giesbrecht had placed in his Dyspontiinae but Sars regarded as intermediate between this group and the Asterocheridae. The two genera are distinguished by the condition of the oral tube, which is short and not extended into a siphon in *Neopontius*, while *Myzopontius* has a well developed siphon.

Genus MYZOPONTIUS Giesbrecht.

Giesbrecht, 1895; 1897; 1899; Sars, 1915, p. 113.

This is a monotypic genus based on Giesbrecht's *M. pungens*. The form found here differs in the first antennae and caudal rami and is regarded as a new species.

MYZOPONTIUS AUSTRALIS sp. nov.

Occurrence. X1, 1 female.

Female. Length 0·87 mm. The body has the same general shape and pro-

portions as in *pungens*. The first antenna has nine distinct segments, with comparatively few setae; the remaining head appendages are much as in the type species but the maxilla has only three inner spinules on the claw and the maxilliped is somewhat bent instead of having straight sides. The legs are like those of *pungens* with the following seta formula:

	endopod.	exopod.
p.1.	1.2.321.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	1.2.221.	1.1.423.

The fifth legs are about twice as long as wide with two terminal and one inner setae. The caudal rami are stoutly built and less than twice as long as wide. The male is unknown.

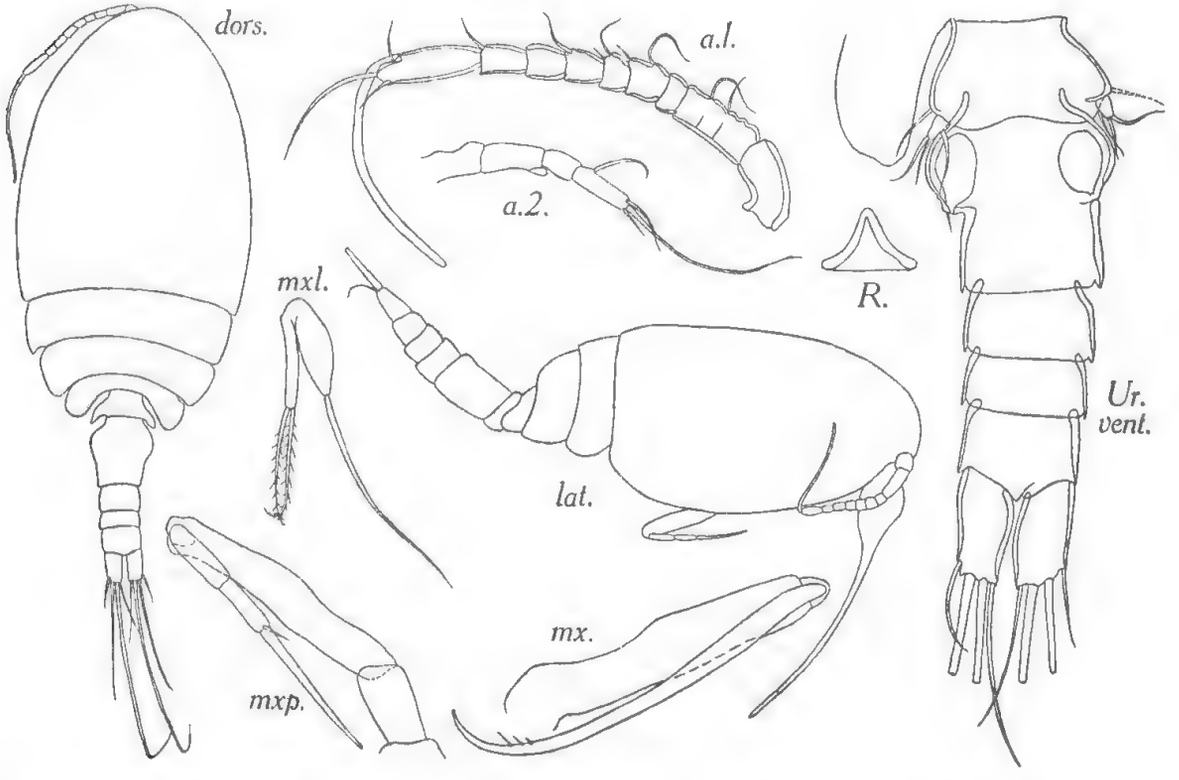

Fig. 9. *Myzopontius australis* sp. nov. Female × 67; urosome and appendages × 200.

FAMILY DYSPONTIIDAE Sars.

Sars, 1915, p. 117.

A key to the genera of this family is given below in which certain genera not referred to by Sars *(loc. cit.)* but identifiable as belonging to the family have been included. It should perhaps be noted here that *Pteropontius* has found its way into the wrong group in Wilson's (1923) key to the Cyclopoida. This genus is characterized by having both rami of the first legs only 2-segmented. Two of the new genera described by Thompson and Scott (1903) are recognizable as belonging to this family. *Metapontius* Hansen (1923) also belongs here and *Urogonia* Brady (1910) probably does, though as with so many of the descriptions in this paper it is too meagre for certain identification. An interesting form occurred in this collection from South Australia, for which a new genus has been required, and will be described below.

The features distinguishing *Cryptopontius* from *Dyspontius* given by Giesbrecht (1899, p. 114) would appear to be better than those used by Wilson (1932, p. 594) since the length of the siphon varies in both genera. The most reliable character is the armature of the first exopod: *Dyspontius* has only two outer spines on the end segment whereas *Cryptopontius* has three.

KEY TO THE GENERA.

1. Rami of first four pairs of legs 3-segmented .. .. 2.
   Rami of first three pairs of legs 3-segmented, fourth pair different .. .. 5.
   Rami of first pair 2-segmented, fourth legs without endopods *Pteropontius* Giesbrecht 1895.
2. Second antenna biramous .. .. 3.
   Second antenna uniramous, 4-segmented .. .. .. *Urogonia* Brady 1910.
3. Fourth endopods reduced in size, with small setae; maxillae and maxillipeds of slender structure .. .. *Bradypontius* Giesbrecht 1895.
   Fourth endopods not reduced, setae normal; maxillae and maxillipeds strongly built .. 4.
4. Posterior corners of head conspicuously notched; epimeral plates pointed diagonally outwards; genital segment about as wide as long .. *Cribropontius* Giesbrecht 1899.
   Posterior corners of head entire; epimeral plates curved backwards parallel with body axis; genital segment twice as wide as long .. .. *Sestropontius* Giesbrecht 1899.
5. Fourth endopod 2-segmented .. .. 6.
   Fourth endopod replaced by a process, seta, spine, or lacking .. .. .. 8.
6. Body longer than wide, thoracic segments free; urosome 4-segmented in female, forming one-fourth of total length .. .. 7.
   Body as wide as long, sub-circular, third and fourth thoracic segments fused; urosome 3-segmented in female, less than one-sixth of total length .. .. *Discopontius* gen. nov.
7. Body with well developed epimera; siphon short and slender, with suctorial tube *Arctopontius* Sars 1915.
   Body without epimera, segments rounded; siphon short and stout, without suctorial tube *Metapontius* Hansen 1923.
8. Second antenna 5-segmented, second segment with 2-segmented exopod; first antenna 18-segmented; urosome 3-segmented, last two segments very short *Cletopontius* Thompson and Scott 1903.
   Second antenna 4-segmented, second segment with one-segmented exopod .. .. 9.
9. Urosome 3-segmented, completely covered by last metasome segment, fifth legs 15 times as long as wide .. .. .. *Lepeopsyllus* Thompson and Scott 1903.
   Urosome entirely free dorsally; fifth legs as wide as long .. .. .. 10.
10. Head wider than long; distal segment of first exopod with two spines *Dyspontius* Thorell 1889.
    Head longer than wide; distal segment of first exopod with three spines *Cryptopontius* Giesbrecht 1899.

Genus CRYPTOPONTIUS Giesbrecht.

Giesbrecht, 1899, pp. 30, 89, 108; Sars, 1915, p. 120.

The genus contains six species: *thorelli, tenuis, capitalis* and *brevifurcatus* (Giesbrecht) 1895; *innominatus* Brady 1910, and *gracilis* Wilson, 1932a. Four new species are described below and a key is given for the identification of the various species.

KEY TO THE FEMALES.

1. Caudal rami wider than long .. .. 2.
   Caudal rami at least as long as wide .. .. 3.
2. Urosome forming little more than one-fifth of the total length *brevifurcatus* (Giesbrecht).
   Urosome forming at least one-fourth of the total length .. *longipes* sp. nov.
3. First antenna with second segment shorter than first and third .. .. .. 4.
   First antenna with second segment longer than either first or third ..*innominatus* Brady.
   First antenna with first two segments sub-equal .. .. *proximus* sp. nov.
4. Siphon reaches beyond the base of the first legs .. .. 5.
   Siphon does not reach the base of the first legs .. .. 8.

5. First antenna 10- or 11-segmented .. .. 6.
   First antenna 9-segmented .. .. 7.
6. Exopod of second antenna with two setae; end segment of first exopod with two inner setae *thorelli* (Giesbrecht)
   Exopod of second antenna without setae; end segment of first exopod with three inner setae *similis* sp. nov.
7. Width of cephalosome about four-fifths of its length .. *tenuis* (Giesbrecht).
   Width of cephalosome equal to its length .. .. *gracilis* Wilson.
8. First antenna 10-segmented; exopod of second antenna with two setae; inner lobe of maxillule with long plumose seta .. .. .. *capitalis* (Giesbrecht).
   First antenna 9-segmented; exopod of second antenna without setae; inner lobe of maxillule with short seta .. .. *latus* sp. nov.

It is uncertain whether *innominatus* should have been included. Brady's specimen was apparently damaged, but the urosome which he figures shows the genital segment of the same width throughout, whereas it is characteristic of the genus that it should be very much widened anteriorly.

CRYPTOPONTIUS SIMILIS sp. nov.

Occurrence. X, 1 female, 1 male.

Female. Length 1·30 mm. The body is of similar shape and proportions to *thorelli*, though less acutely pointed anteriorly. The first antenna is 10-segmented, with the third to seventh and ninth to eleventh segments fused. The second antenna has a small unarmed exopod; the end segment is without lateral setae but has a row of fine hairs. The siphon reaches to the base of the first legs but not beyond. The maxillule has both lobes slender, the outer two-thirds as long as the inner and armed with a short seta and small spine, the inner lobe armed with two slender spines. The maxilla and maxilliped are very like those of *thorelli*. The swimming legs are normal, with the following seta formula:

	endopod.	exopod.
p.1.	1.2.321.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	—	1.1.423.

The fifth leg is twice as long as wide, with one spine and a seta. The caudal rami are longer than wide (about 4:3).

Male. Length 1·02 mm. The body is more slender than that of the female, as is usual in this genus, and the urosome is five-segmented. The first antenna has eleven distinct segments, the large sensory filament being placed sub-terminally on the end segment. There is a series of long thin sensory filaments distributed as follows: one on the second and eighth segments, two on the sixth and ninth and four on the third segment. The ninth segment also has two short spines near the bases of the filaments. The mouth parts and legs are as in the female and the caudal rami have a similar proportion and armature.

This species is very close to *thorelli*, particularly in the shape and proportions of the body, its size, the first antennae, maxillae and maxillipeds. It differs in the proportions and armature of the maxillule and in the armature of the second antenna and first leg. In this leg in *thorelli* the seta formula is 1·1·321; 1·1·223. It is unfortunate that Giesbrecht (1899) has not illustrated the fourth legs of the species of this genus described therein as there is some variation in the second segment of the basipod of this leg in the species found here. In this species there is a small prominence on this segment, which may represent the missing endopod. In *longipes*, described below, this prominence is well developed, whereas the two other species described here are without any such prominence.

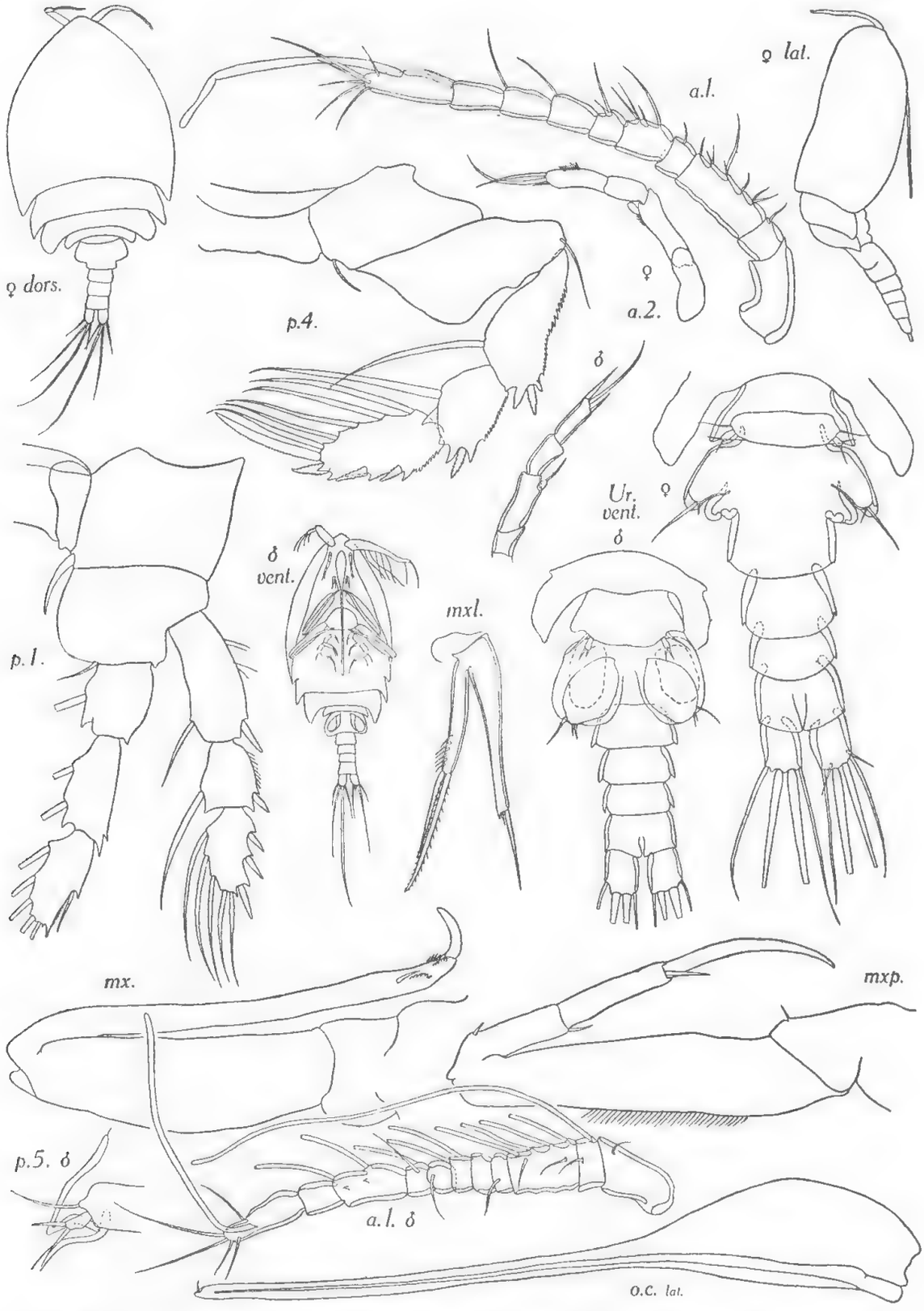

Fig. 10. *Cryptopontius similis* sp. nov. Male and female × 30; urosome, both sexes, × 110; appendages × 185.

CRYPTOPONTIUS LATUS sp. nov.

Occurrence. XII, 1 female.

Female. Length 1·30 mm. The body is of similar proportions and size to *capitalis,* having the head segment distinctly wider than long. The first antenna is 9-segmented, the third to seventh and eighth to tenth segments being fused.

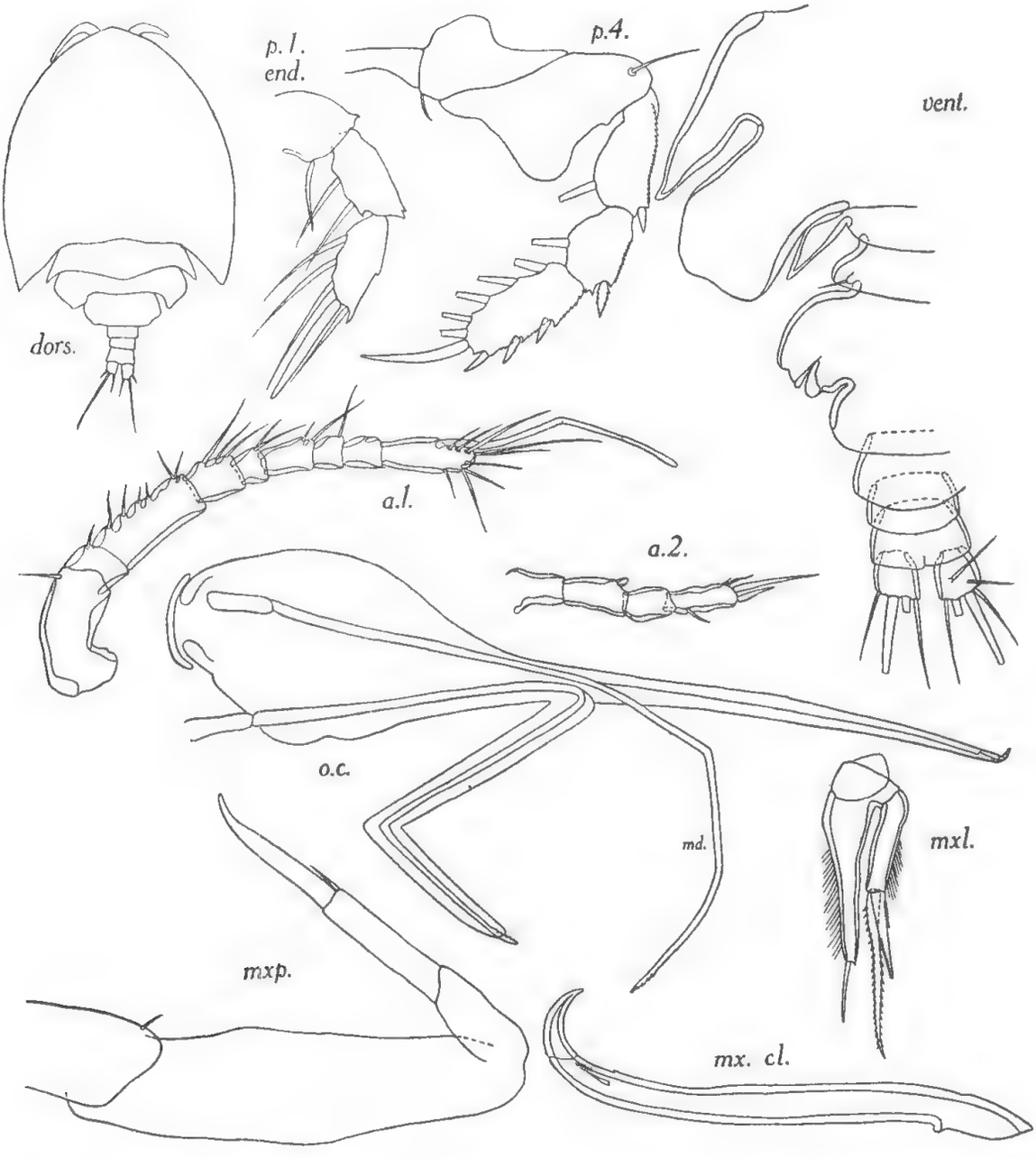

Fig. 11. *Cryptopontius latus* sp. nov. Female × 32; urosome × 120; appendages × 200.

The second antenna has a very small, unarmed exopod, the end segment has a lateral seta and two terminal spines and a small seta. The siphon is very short, not reaching the base of the first legs. The maxillule has two strong spines on the outer lobe and a single short seta on the inner. The maxilla has the terminal portion of the claw fused with the proximal portion and strongly curved. The swimming legs have the following seta formula:

	endopod.	exopod.
p.1.	1.2.320.	1.1.223.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	—	1.1.423.

The fifth legs are composed of small rounded knobs, each bearing a single seta. The caudal rami are as long as wide.

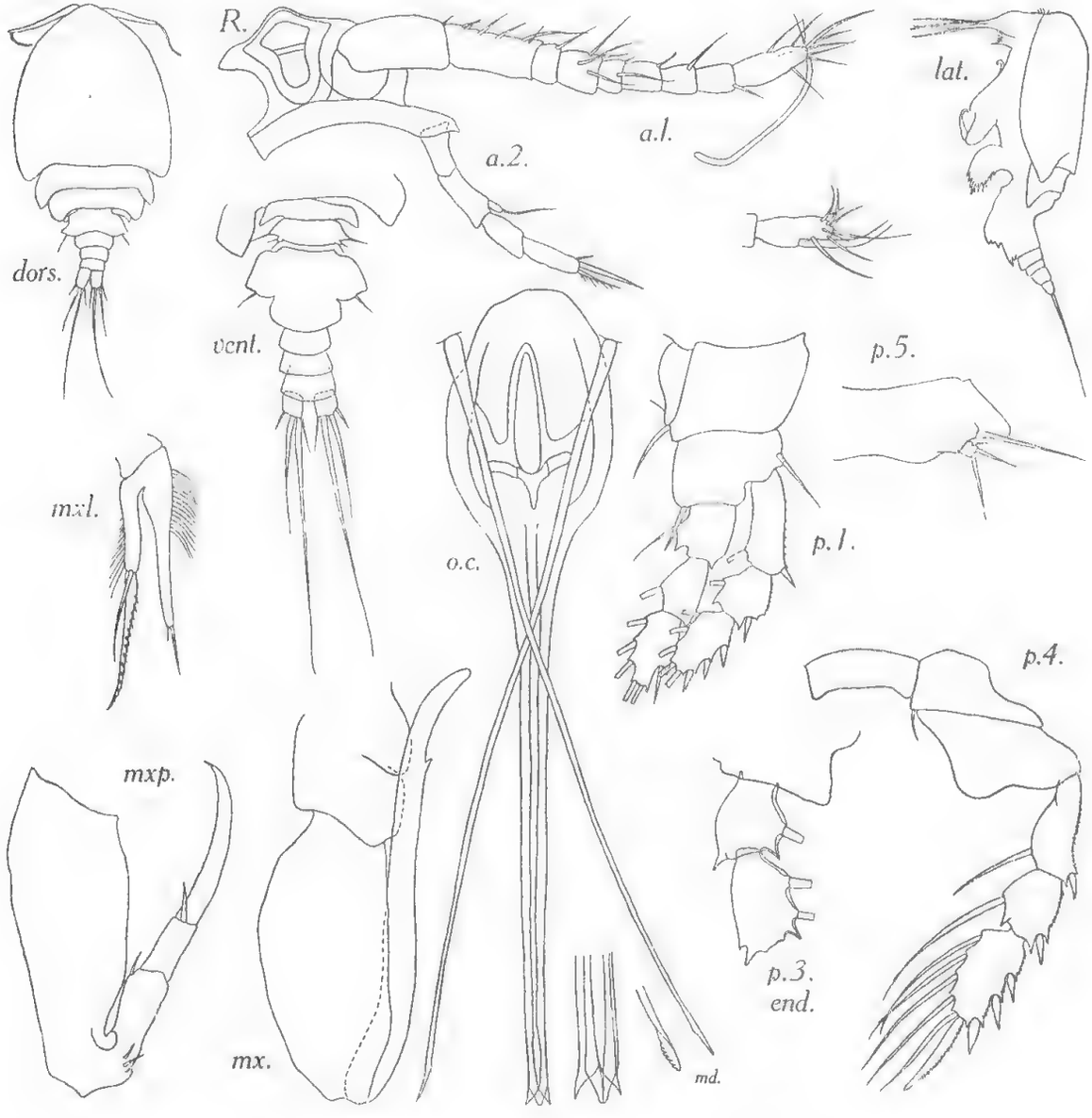

Fig. 12. *Cryptopontius proximus* sp. nov. Female × 32; urosome × 67; appendages × 200; terminal portions of siphon and mandible × 333.

This species approaches *capitalis* very closely and should perhaps be identified with that species, but there are several minor points of difference. In *capitalis* the eighth segment of the first antenna is free, whereas here it is fused with the ninth and tenth; the inner lobe of the maxillule has a single relatively short unarmed seta in place of the longer plumose seta and small spur of Giesbrecht's species; the exopod of the second antenna is unarmed.

It is regrettable that the species of this genus found here (with one exception) occurred as isolated specimens, since the examination of a series might show sufficient variation to permit of this species and *similis* being included in *capitalis* and *thorelli* respectively.

CRYPTOPONTIUS PROXIMUS sp. nov.

Occurrence. IX, 1 female.

Female. Length 1·02 mm. The body is much as in *similis,* having the head segment about as wide as long, but the first free thoracic segment has the lateral projections more rounded. The first antenna is 9-segmented, the first two segments sub-equal, the second to seventh and ninth and tenth being fused. In the second antenna the exopod bears a single long terminal seta, and the end segment one spine and two setae. The siphon scarcely reaches the base of the first legs. The maxillule has slender lobes, the outer armed with a stout spine and a shorter seta, the inner with a very short seta and small spine. The maxilla has the terminal portion undivided and ends in a blunt curved claw. The swimming legs have their seta formula as follows:

	endopod.	exopod.
p.1.	1.1.321.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	—	1.1.423.

The fifth legs are almost square, with two terminal and one lateral setae and the caudal rami are a little longer than wide.

This species resembles *similis* in the shape of the body, but in other features it approaches more closely to *latus*. It differs in several particulars: in the first and second antenna, the armature of the first legs and in the fifth legs. The siphon also is relatively longer and the species is considerably smaller than *similis*.

CRYPTOPONTIUS LONGIPES sp. nov.

Occurrence. IX, 3 females; X, 2 males; XII, 1 male; XIII, 1 male.

Female. Length 1·13 mm. The body is comparatively slender, its width less than half the total length; the width of the head segment is five-sixths of its length. In the urosome the genital segment has a comparatively short undilated posterior portion, which is wider than the following segments. Of these the first two are short and sub-equal and together no longer than the anal segment. The caudal rami are wider than long.

The first antenna is 9-segmented, the first two segments are sub-equal, the second to seventh and ninth and tenth being fused. The second antenna has a very short basal segment; the exopod is minute and unarmed; the end segment has no lateral seta but a fringe of hairs, and two unequal terminal setae. The siphon is comparatively long, reaching beyond the base of the first legs. The maxillule has two stout spines on the outer lobe and two long delicate setae on the inner lobe. The maxilla has the terminal part of the claw separated from the proximal portion and the maxilliped has the two distal segments fused. The seta formula for the swimming legs is:

	endopod.	exopod.
p.1.	1.?.320.	1.1.223.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	—	1.1.423.

The armature of the first legs is somewhat uncertain, as these were so strongly curved inwards and forwards that on mounting they broke up and the setae were

dislodged, or the rami overlapped to such an extent as to make it difficult to be certain of the setae. The fourth legs are distinguished from those of other species found here by the presence of a well-developed prominence on the basipod, adjacent to the exopod. The distal segment of the leg on one side had only three

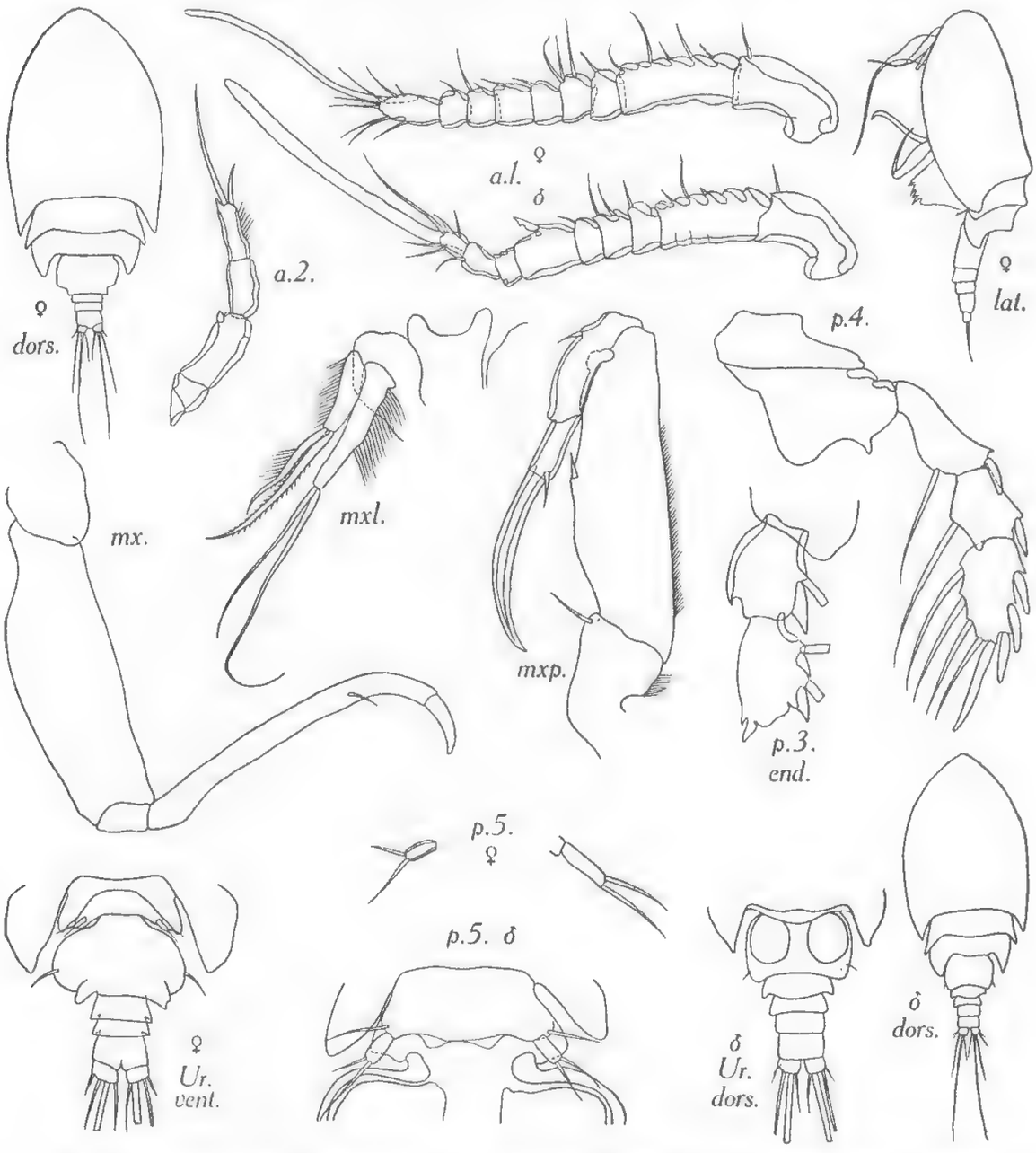

Fig. 13. ***Cryptopontius longipes*** **sp. nov. Male and female × 32; urosome, both sexes, × 67; appendages × 200.**

inner setae, instead of four, which is the more usual number. The fifth legs also distinguish this species from any other in that they are more than twice as long as wide; in one specimen they were nearly four times as long as wide.

Male. Length 1·04 - 1·15 mm. The body is more slender than that of the female. The first antenna is 9-segmented, with the first two segments sub-equal and showing a fusion of segments similar to that of the female. The sixth free segment is elongate and bears a barbed spine; the terminal portion, consisting of

two segments, is weakly geniculate upon the preceding segment. The fifth legs are somewhat shorter than in the female but twice as long as wide, and similarly armed. Apart from the 5-segmented urosome, the male resembles the female in all other respects.

This species is distinguished from all the other species by the genital segment and urosome of the female and by the elongate fifth leg. It resembles *brevifurcatus* in having the caudal rami wider than long, but differs from it in so many respects that it must be regarded as distinct.

DISCOPONTIUS gen. nov.

Body sub-circular in outline, with a small projecting urosome, and the whole considerably flattened so as to be disc shaped. The segments are without epimeral plates and the first segment is fused with the head; the third and fourth segments are fused and completely cover the fifth segment dorsally. The urosome is very short, 3-segmented; the genital segment is greatly enlarged and longer than the rest of the urosome, including the caudal rami, and a little more than three times as wide as the other urosome segments. The mouth parts in general show the characters of the family. The first three pairs of legs have 3-segmented rami, the exopod of the fourth pair is 3-segmented and the endopod 2-segmented with reduced setae. The fifth legs are well developed, 1-segmented, and project posteriorly from beneath the metasome.

In the condition of the swimming legs this genus approaches *Arctopontius*: the first three pairs have normal rami while in the fourth pair the endopod is reduced to two segments. Sars' genus moreover has a somewhat expanded metasome and the cephalic appendages are not unlike those of his genus. The first antenna is of similar structure, though the sensory filament is sub-terminal; the second antenna has the second and third segments considerably larger than either first or fourth, whereas in *Arctopontius* they are sub-equal. The siphon is less produced than in Sars' genus, but the maxilla and maxilliped are very similar. In *Discopontius* the body is sub-circular in outline and the female urosome is 3-segmented (in *Arctopontius* 4-segmented); the third and fourth metasome segments are fused, an unusual feature, and dorsally cover the free fifth segment. These segments are all without epimeral plates, whereas in Sars' genus the segments are distinct and have well-developed epimera. The genital segment is enlarged in both. In conformity with the flattened body the bases of the swimming legs are very wide; the fifth legs are well-developed, whereas in *Arctopontius* they are represented only by setae. In shape this genus resembles *Doropontius* Thompson and Scott (1903), but their genus is clearly an Asterocherid in structure. *Cletopontius* of the same authors is also of a similar appearance, and belongs to the Dyspontiidae, but differs in many respects, particularly the second antenna, maxilla, and fourth legs in which there is no endopod. The urosome is also 3-segmented in *Cletopontius*, but the anal segment is no larger than the pre-anal, whereas here it is twice as large.

DISCOPONTIUS DISCOIDES sp. nov.

Occurrence. IX, 1 female.

Female. Length 0·74 mm.; width 0·67 mm. The body has been described under the characters of the genus. The first antenna has thirteen distinct segments, with a sensory filament distally on the eleventh; the second to eighth segments are fused. The second antenna is 4-segmented, with a small exopod attached to the second segment at a little past the middle; the fourth segment is very short and bears terminally one spine and two setae. The oral cone is short and stout, slightly produced into a siphon. The maxillule has a short slender outer

lobe, with a single seta and a longer stouter inner lobe bearing four setae. The maxilla and maxilliped are of very strong construction, resembling those of *Arctopontius,* but the distal portion of the maxillary claw is not divided from the proxi-

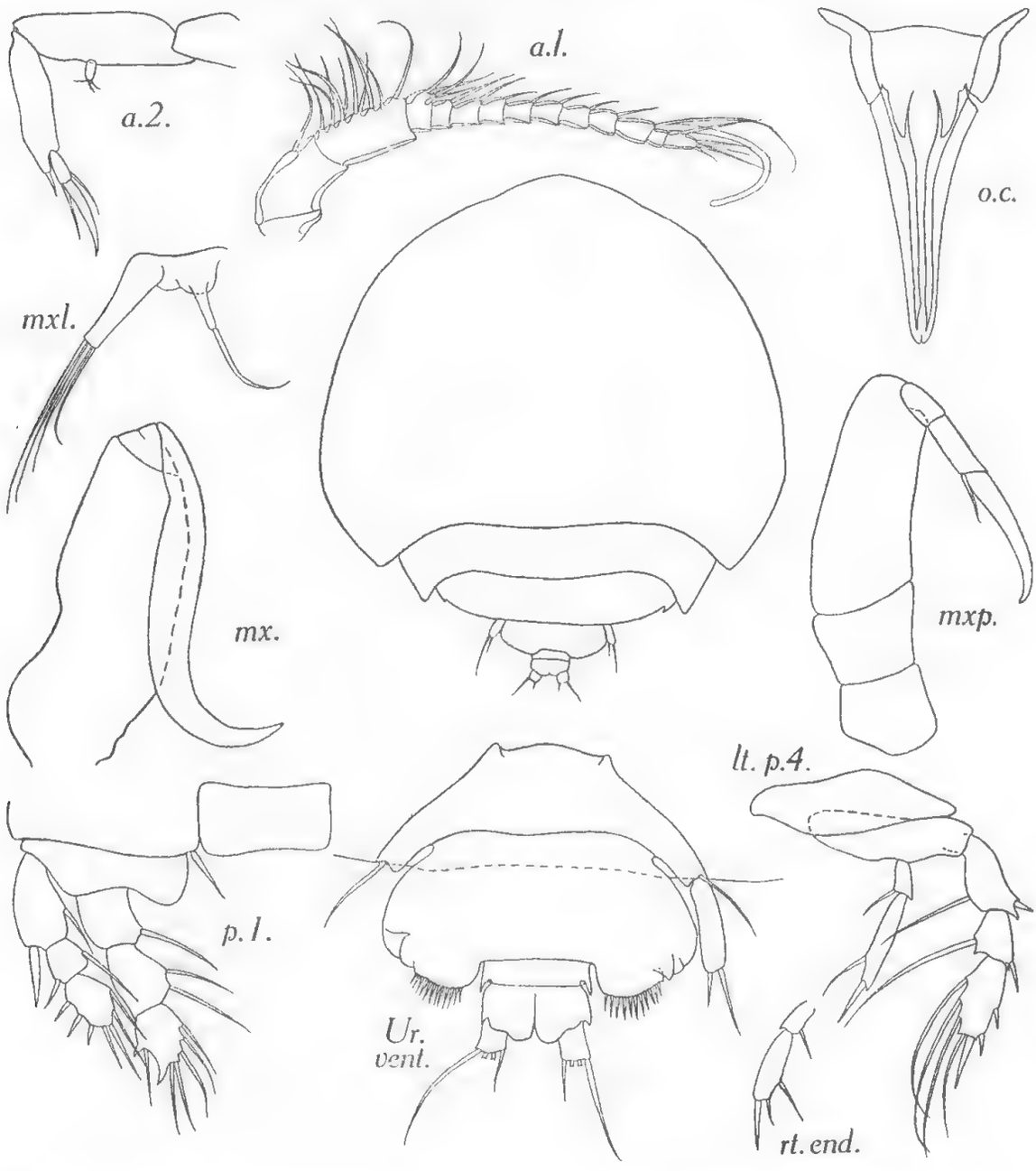

Fig. 14. *Discopontius discoides* gen. et sp. nov. Female × 80; urosome and appendages × 240.

mal portion. The swimming legs have 3-segmented rami, except the fourth endopod, which is 2-segmented and with reduced setae. The seta formula is:

	endopod.	exopod.
p.1.	1.2.321.	1.1.223.
p.2.	1.2.321.	1.1.323.
p.3.	1.2.321.	1.1.323.
p.4.	—	1.1.322.

The fourth endopod was of slightly different structure on opposite sides; that on the left leg had a longer distal segment with one inner seta and a terminal spine; on the right leg the distal segment had a small terminal seta as well as the spine. The fifth leg is one-segmented, the basal segment being fused with the body; the distal segment is four times as long as wide, curved, and reaches to the middle of the pre-anal segment. The caudal rami are slightly longer than wide, though shorter than the anal segment, and armed with four terminal setae, the two middle ones of which were broken so that their length is unknown. The genital segment is armed along its posterior margin with a fringe of short spines. No egg-sacs were present. The male is unknown.

Genus BRADYPONTIUS Giesbrecht.

Giesbrecht, 1895, 1899, pp. 88, 107; Sars, 1915, p. 124.

One of the most characteristic features of this genus is the endopod of the fourth leg, which is always more slender than the exopod and has the setae reduced in number and size while retaining the full number of segments.

There are twelve species in the genus: *magniceps* (Brady), 1880; *papillatus* (T. Scott), 1888; *chelifer* and *siphonatus* Giesbrecht, 1895; *ignotus* and *serrulatus* Brady, 1910; *major* and *caudatus* Sars, 1915; *groenlandicus*, *dentatus*, *unidens* and *tenuipes* Hansen, 1923.

It should be noted that Sars (*loc. cit.*, p. 127), regards *chelifer* as a synonym of *papillatus*; it would appear, however, that the differences are sufficiently marked for it to be regarded as distinct. Three new species have been found in this collection and a key is given for their identification from which only *dentatus* has been excluded because the specimen described by Hansen was so damaged as to render impossible the description of the legs.

KEY TO THE SPECIES (BOTH SEXES).

1. Fifth leg reduced to small round knobs, not more than twice as long as wide .. 2.
   Fifth leg elongate, about five times as long as wide .. .. ♀ *tenuipes* Hansen 1923.
2. Fourth endopod with inner seta on the basal segment and usually two setae on the middle segment .. .. 3.
   Fourth endopod without inner seta on the basal segment and never more than one on the middle segment .. .. 10.
3. Fourth endopod with five setae on the terminal segment .. .. .. 4.
   Fourth endopod with four setae on the terminal segment .. .. .. 7.
4. First antenna 12- or 13-segmented .. .. 5.
   First antenna 8-segmented .. .. .. ♀ *magniceps* (Brady) 1880.
5. Middle segment of fourth endopod nearly twice as long as the basal segment ♂♀ *caudatus* Sars 1915(3).
   Middle segment of fourth endopod little longer than the basal segment .. .. 6.
6. Claw of maxilla with lateral spine and spur .. .. ♀ *major* Sars 1915.
   Claw of maxilla with lateral spine and denticles, no spur .. ♂ *unidens* Hansen 1923.
7. First antenna 11-segmented in female, 13-segmented in male ♂♀ *groenlandicus* Hansen 1923.
   First antenna 8- or 9-segmented in female, 11-segmented in male .. .. 8.
8. Fourth endopod without setae on middle segment .. .. ♀ *serrulatus* Brady 1910.
   Fourth endopod with two setae on middle segment .. .. 9.
9. Fourth endopod as long as exopod .. .. .. ♀ *ignotus* Brady 1910.
   Fourth endopod much shorter than exopod .. ♂♀ *papillatus* (T. Scott) 1888.
10. Caudal rami at least as long as wide .. .. 11.
    Caudal rami wider than long .. .. 13.

(3) Sars (1915, p. 129) in a footnote states that the male identified as that of *major* is more probably that of *caudatus*.

11. First antenna 8-segmented in female, 11- or 12-segmented in male; distal segment of fourth endopod the longest .. .. 12.
First antenna 9-segmented in female; proximal segment of fourth endopod the longest
♀ *serratipes* sp. nov.

12. Caudal rami longer than wide .. .. ♂♀ *chelifer* Giesbrecht 1895.
Caudal rami as wide as long .. .. ♂ *ovatus* sp. nov.

13. First antenna 10-segmented in female, 12-segmented in male ♂♀ *siphonatus* Giesbrecht 1895.
First antenna 9-segmented in female, 11-segmented in male .. ♂♀ *inermis* sp. nov.

BRADYPONTIUS INERMIS sp. nov.

Occurrence. IX, 2 females; X, 4 females (1 ovigerous), 1 male, 3 juveniles; XI, 17 females; XII, 1 juvenile ?; XIII, 4 females (2 ovigerous).

Female. Length 1·11 - 1·50 m.m. The body is wide anteriorly, its greatest width being about three-fifths of the total length; the head segment is as wide as long. The first antenna is composed of nine distinct segments, the second to seventh and ninth and tenth being fused; the second segment is partially separated in some specimens and entirely free in others; when it is free, then the eighth segment is fused with the preceding segment so that the total number is always nine. The second antenna has a small exopod bearing two small setae. The siphon extends beyond the posterior margin of the head segment. The maxillule has the outer lobe armed with one spine and a thin seta, and the inner lobe has a single long delicate seta; the maxilla and maxilliped are without specific characteristics. The swimming legs have the following seta formula:

	endopod.	exopod.
p.1.	1.2.320.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	0.0.010.	1.1.423.

As is usual in this genus in preserved specimens the swimming legs are found with the rami bent forwards and inwards so that they tend to overlap when mounted. The second leg, which has been figured, has been drawn with the rami artificially separated. The fifth leg is composed of a rounded knob, bearing two setae. The caudal rami are wider than long and about half the length of the anal segment.

Male. Length 1·07 mm. The body is more slender than that of the female, the width of the head being only three-fourths of its length. The first antenna has eleven distinct segments, the third to sixth being fused; the ninth segment is elongate and bears a distal hook, while the terminal segment is bent upon the tenth segment and bears a long stout sensory filament. Segments two to nine bear a large number of very thin sensory filaments, little thicker than an ordinary seta. These are very long and only a few have been shown in the figure; the impression gained from an examination of the whole animal is that the antennae are clothed with a brush of dense setae.

Giesbrecht (1899, p. 29) states that the males in both *chelifer* and *siphonatus* have a large number of long thin sensory filaments one on each free and fused segment from two to twelve (eighth segment excepted in *chelifer)* and two on each from thirteen to sixteen. In this species the distribution is from segments two to nine (distinct segments) but the proximal ones overlie the points of attachment of the more distal ones so as partially to hide the points of insertion. There are between sixty and seventy altogether.

The second antenna bears a lateral seta on the end segment, not found in the female (possibly broken off) and the maxilliped shows the modification of the basal portion found in the male of *siphonatus*.

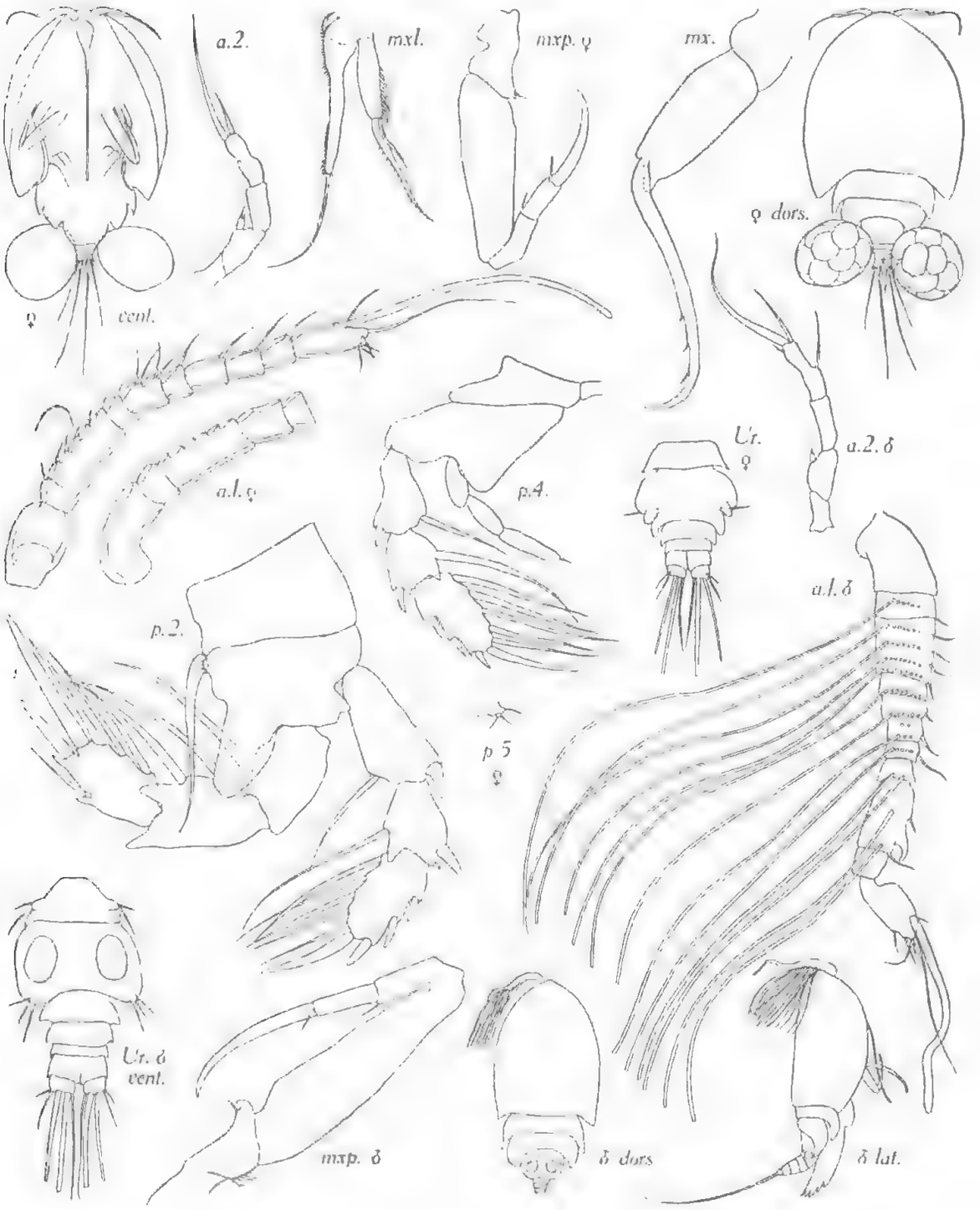

Fig. 15. *Bradypontius incrmis* sp. nov. Male and female × 27; urosome of female × 57; maxilla, maxilliped, and fifth legs of female, and urosome of male × 103; other appendages × 171.

The species resembles *siphonatus* in a number of features, but differs in the shape of the body in the male, the first antenna in both sexes, the proportions of the segments in both second antenna and maxillule, the rather more robust maxilliped in the female, and the armature of the fourth endopod. These two species are the only ones described as having the caudal rami wider than long.

BRADYPONTIUS SERRATIPES sp. nov.

Occurrence. XII, 1 female.

Female. Length 1·52 mm. The body is comparatively slender, its greatest width being about half the total length; the head segment is longer than wide and the urosome forms about one-third of the total length. The first antenna has nine distinct segments, the third to eighth and ninth and tenth being fused.

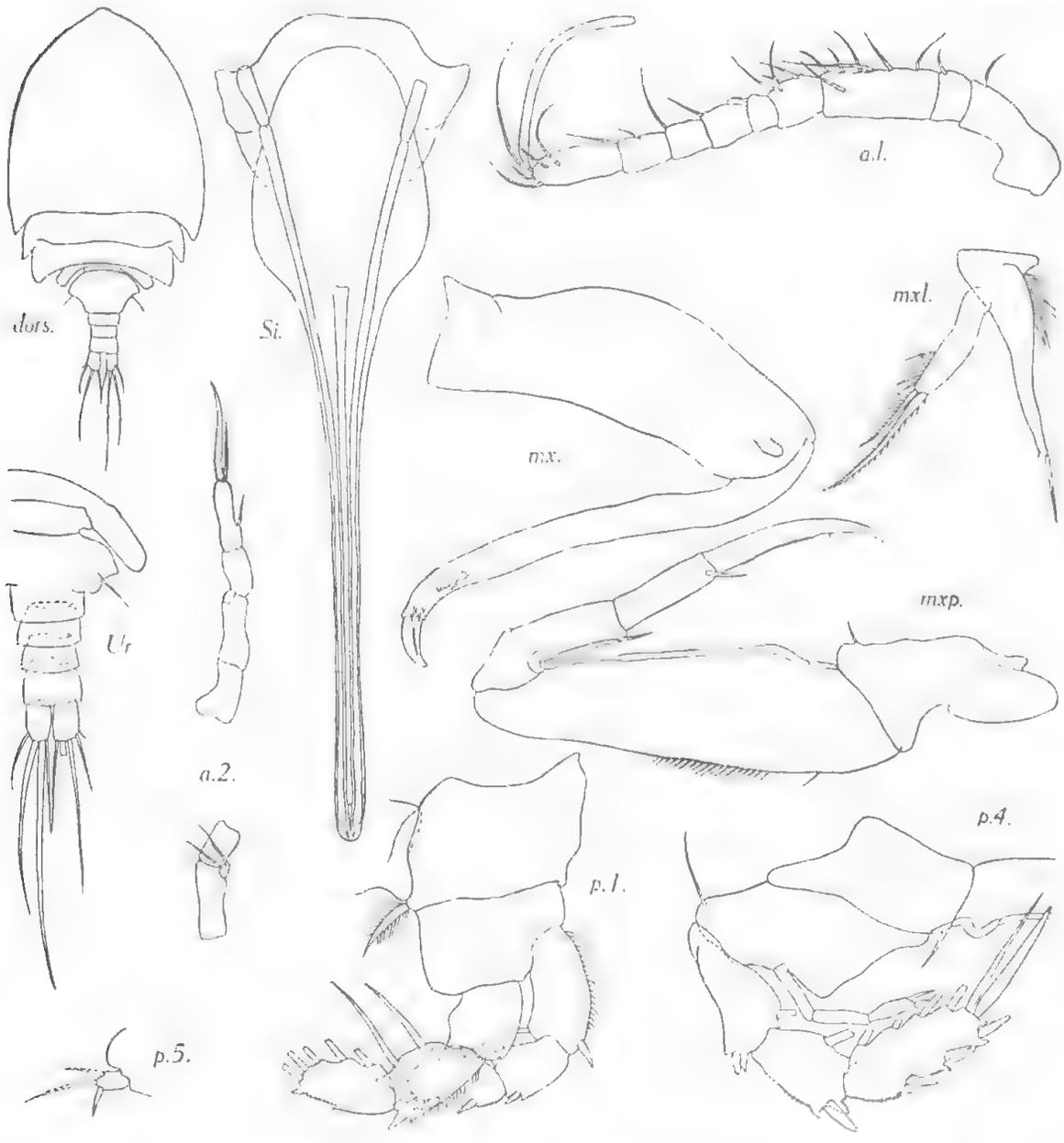

Fig. 16. *Bradypontius serratipes* sp. nov. Female × 27; urosome × 57; appendages × 171.

The exopod of the second antenna has two long setae, the end segment has a lateral seta as well as the terminal seta and spine. The siphon is short, not reaching the base of the first legs. The maxillule has a short terminal seta on the inner lobe; the maxilla and maxilliped are stoutly constructed. The outer margins of

the exopods of legs two to four are strongly serrate, that of the first leg less so. Seta formula:

	endopod.	exopod.
p.1.	0.2.320.	1.1.323.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.321.	1.1.423.
p.4.	0.0.020.	1.1.423.

The fifth leg is short, sub-rectangular, not twice as long as wide and with probably three setae, only one of which was seen. The caudal rami are less than twice as long as wide and about as long as the anal segment.

The species resembles *chelifer* in some respects, but is more slender, has the second segment of the first antenna free, and lacks the inner setae on the second and third segments of the fourth exopod present in that species. The serrations on the exopods are also probably more strongly developed.

BRADYPONTIUS OVATUS sp. nov.

Occurrence. XI, 2 males.

Female unknown. Male. Length 0·89 - 0·95 mm. The body is oval in outline, with the thoracic epimera not pronounced and directed backwards. The first antenna has twelve distinct segments, the ninth having a stout spur (which is not hooked) on the anterior margin; the penultimate segment bears the usual large sensory filament and there is a series of thin delicate filaments inserted on each of the segments from the second to the ninth. The mouth parts show no specific characters except for the maxilla, the claw of which has a small seta

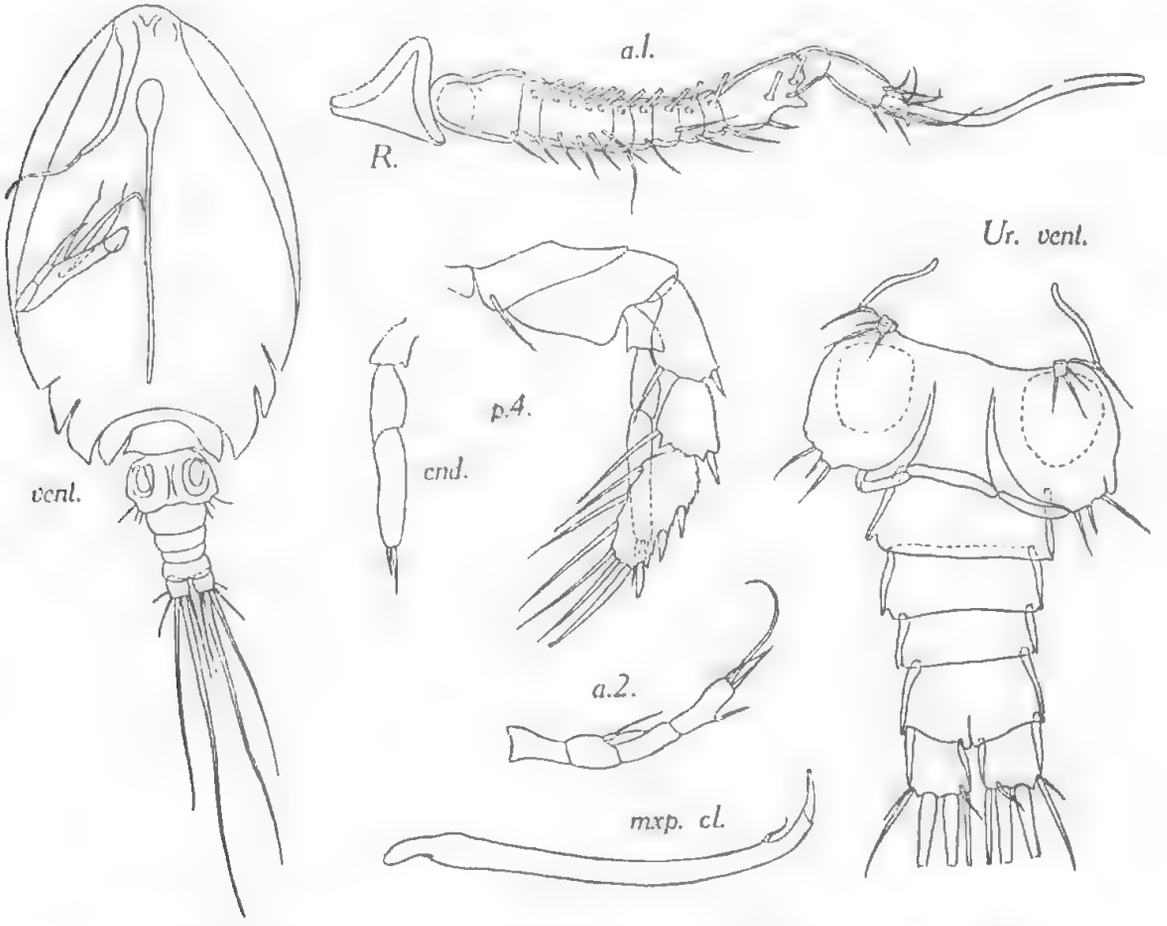

Fig. 17. *Bradypontius ovatus* sp. nov. Male × 64; appendages × 192.

near the end. The siphon extends to beyond the base of the second legs. The armature of the legs differs from that of *serratipes* only in having an inner seta on the basal segment of the first endopod. The fourth endopod is comparatively unarmed, like the other Mediterranean and Australian species, but differs from these in the proportions of the segments; the distal segment is as long as the first two together, and armed with two small terminal setae, these being the only setae on the ramus. The fifth legs are longer than wide, with two terminal and one outer marginal setae. The caudal rami are as long as wide and slightly shorter than the anal segment.

The species comes closest to *chelifer*, but differs in several respects, particularly in the armature of the fourth endopod.

It is of interest to note that all those species with reduced armature on the fourth endopod are either from the Mediterranean or from Australian waters, whereas all the others are from the colder regions of the northern or southern oceans and have fully armed fourth endopods.

Genus PTEROPONTIUS Giesbrecht.

Giesbrecht, 1895; 1899, pp. 91, 110.

According to Giesbrecht this genus is characterized by the postero-lateral projections from the thoracic and anterior urosome segments; the first thoracic segment is fused with the head, with a dorsal crest along its whole length; the second antenna is only three-segmented; the fourth leg is without an endopod; both rami of the first leg are two-segmented, with reduced setae; the distal segments of the third and fourth exopods have only two outer spines; and the fifth leg is knob-like. He described a single species, *cristatus* (1899, p. 36-8, pl. vii, fig. 24-39; x, fig. 15-17) and Brady (1910, p. 583, fig. lxvi) described a second, *scaber*; the species found here is distinct from both of these.

In the South Australian species the dorsal crest described for the head segment is continued along the second and third thoracic segments; the second antenna is only indistinctly three-segmented; the basipod of the fourth leg is composed of a single segment (as in *cristatus*. Giesbrecht, *op. cit.*, p. 37); and the exopods have three outer spines. It would appear that the segmentation of the fourth basipod may be a generic character while the armature of the third and fourth exopods is not of generic value. The very short, strongly built siphon appears also to be common to all three species of the genus.

As mentioned above, the genus is wrongly placed in Wilson's key (1932) but it is not surprising that minor errors have crept in when constructing keys of such magnitude as those prepared by Dr. Wilson.

Brady's description and figures for *scaber* are sufficient for the identification of his species as a member of the genus, which is well characterized by the lateral expansions of the thoracic and anterior urosome segments. His species differs notably in the shape of the body.

KEY TO THE FEMALES.

1.	Head segment wider than long	2.
	Head segment longer than wide	*scaber* Brady 1910.
2.	End segments of third and fourth exopods with two outer spines	*cristatus* Giesbrecht 1895.
	End segments of third and fourth exopods with three outer spines	*barbatus* sp. nov.

PTEROPONTIUS BARBATUS sp. nov.

Occurrence. IX, 1 female.

Female. Length 1·02 mm. The head segment is wider than long, with the rostral region slightly pronounced and having a small triangular rostrum

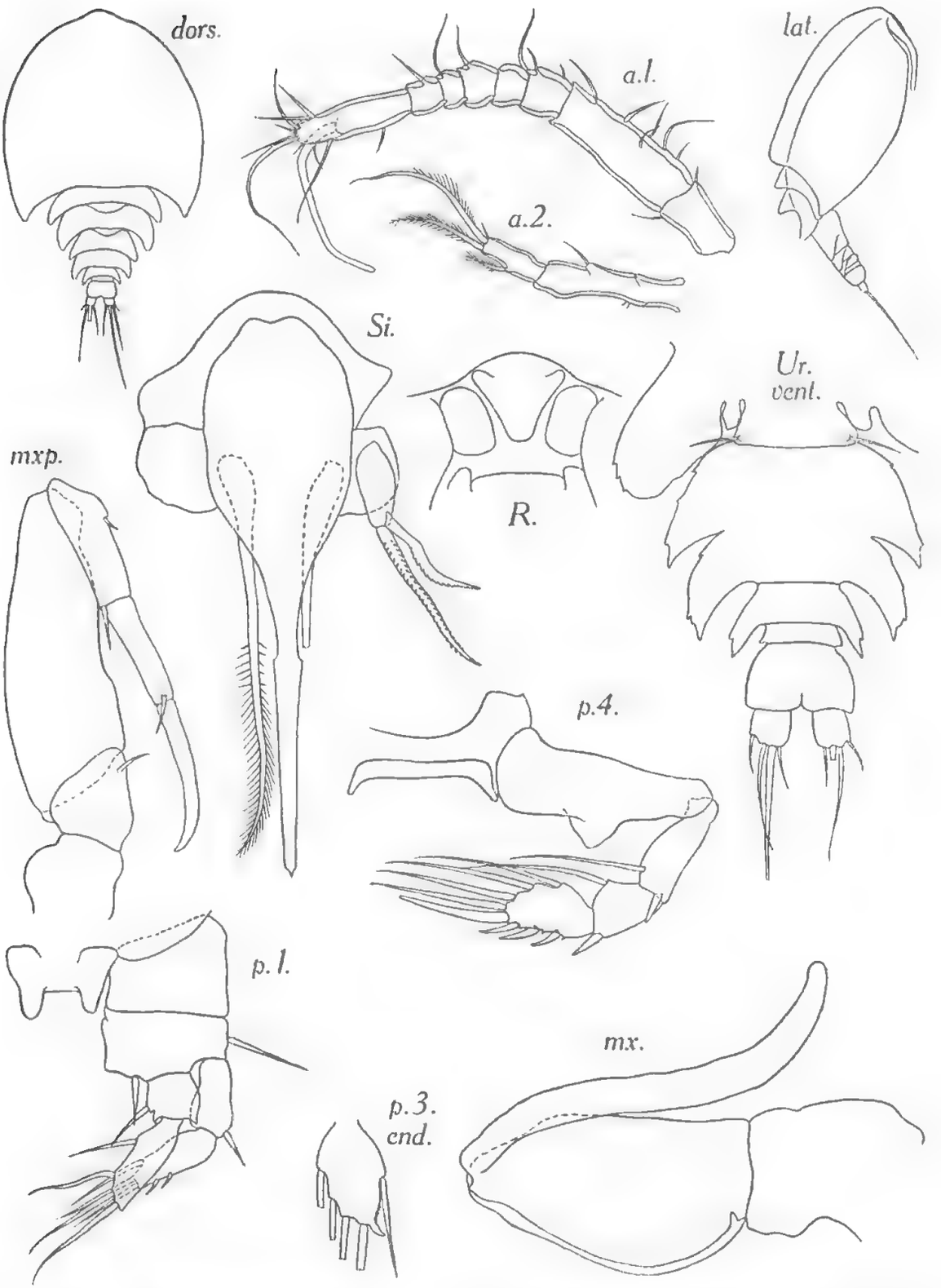

Fig. 18. *Pteropontius barbatus* sp. nov. Female × 38; rostrum and urosome × 144; appendages × 240.

ventrally; a well-developed dorsal crest runs along this and the two following segments which, together with the genital and second urosome segments, have well-developed epimeral plates with somewhat serrated edges. The genital segment

bears two such plates on each side. The first antenna is composed of eight distinct segments, the long second segment probably being composed of segments two to eight as in *cristatus*, but the fusion is so complete that it is difficult to make out the individual segments. The second antenna appears to be composed of only two segments but the basal segment is indistinctly and incompletely divided near the base, in a position comparable to that of *cristatus*. As in that species the end segment bears one small lateral and two longer unequal terminal setae, all plumose. The siphon is typical in being short and strongly built, with the distal portion little, if any, longer than the large base; it is distinct in having a pair of barb-like projections near the base of the tubular portion, hence the specific name. The maxillule is almost exactly as in *cristatus*, except that the shorter of the two spines on the outer lobe is sickle-shaped. The maxilla and maxilliped are of very strong construction, particularly the former, in which the basal segment is very powerful and the claw a long, strong, one-segmented structure distally curved and bluntly rounded terminally. The maxilliped is like that of *cristatus*, though more powerful.

The first pair of legs shows the typical two-segmented rami, with reduced setae; the second, third, and fourth exopods all have three outer spines on the end segment. The fourth endopod is absent but, as in *cristatus*, there is a large projection from the basal segment which is composed of the normal two segments (coxa and basis) completely fused. The seta formula for the legs is:

	endopod.	exopod.
p.1.	1.220.	0.122.
p.2.	1.2.321.	1.1.423.
p.3.	1.2.311.	1.1.423.
p.4.	—	1.1.323.

The end segment of the third endopod lacks the terminal spine and both second and third legs have the triangular prominence shown on the fourth basipod; this appears to correspond to the inner corner of the basipod of the first leg, somewhat displaced owing to the shape of the basipods in these legs. The fifth legs are reduced to minute rounded knobs bearing each a single seta.

The anal segment is dilated posteriorly and the caudal rami are about as wide as long and a little more than half of the anal segment. This species is of similar size to *cristatus* but much smaller than *scaber* (3·5 mm.). The male was not seen.

FAMILY ARTOTROGIDAE Sars.

Sars, 1915, p. 132.

The family was created by Sars for two genera, *Artotrogus* and *Dystrogus*, in which the body tends to be sub-circular and the fourth legs are absent. In the latter feature they approach the Cancerillidae, but those are distinguished from other Siphonostoma in having the second antenna modified into strong prehensile organs.

Artotrogus has hitherto been known only from the female (a male was found here), while *Dystrogus* is known only from the male.(3)

According to Giesbrecht (1899, pp. 110-111) they are distinguished by the siphon, which tapers to a more or lesss narrow tube in *Artotrogus*, while in *Dystrogus* it is of the same width throughout. The other characters quoted by

(3) Brady (1910, p. 583) described a species as *Dystrogus uncinatus* from a female. But this clearly has four pairs of legs, according to his statement, and cannot therefore belong to this family.

him are probably sexual, as in the difference in the genital segment, or only of specific value, as in the armature of the swimming legs and shape of the fifth leg. Probably of generic value is the shape of the body; in *Artotrogus* it is always sub-circular, with the urosome scarcely, if at all, projecting beyond the epimeral plates of the thorax; in *Dystrogus* the body is ovoid and the posterior segments of the urosome project well beyond the thoracic epimera.

Sars *(op. cit.,* p. 134) suggests that the shape of the female of *Dystrogus* when known may prove to resemble that of *Artotrogus*, implying that the difference in shape is sexual. This is not borne out by the male of *Artotrogus* found here, which is sub-circular like the female, whereas if Sars' implication were correct it might be expected more to resemble *Dystrogus* in shape.

Genus ARTOTROGUS Boeck.

Boeck, 1859; Giesbrecht, 1899, pp. 92, 111; Sars, 1915, p. 132.

It would appear that G. M. Thomson followed Brady (1880, p. 59), who quite unjustifiably regarded *Asterocheres, Ascomyzon* and *Artotrogus* as synoymous. Brady's chief reason for choosing the latter name for the genus was that it was "less objectionable" than *Asterocheres* and has priority over *Ascomyzon.* Whereas the two former are synonymous, *Artotrogus* is distinct. Giesbrecht (1899, p. 118) includes a list of synonyms and disposes of those species wrongly assigned to this genus up to the time when he wrote. The following species have since been added: *brevicaudatus* Brady, 1899; *gigas* and *sphaericus* Brady, 1910; *proximus* T. Scott, 1912; and *australis* Wilson, 1923.

Of the first of these Brady *(loc. cit.* p. 49) states that "The mouth organs and swimming feet present no distinctive characters" from which we can only assume that in these features the species agrees with Brady's diagnosis for the genus given in 1880 (p. 59). Here it is evident that he has overlooked the absence of the fourth leg in Boeck's species *orbicularis*, which is a true *Artotrogus.* We must, therefore, assume that *brevicaudatus* has a normal fourth leg, with three-segmented rami. From the figure of the whole animal (pl. xiii, fig. 22), showing well developed epimera, and that of the urosome (fig. 26) showing the genital segment widened anteriorly, it is clearly a member of the Dyspontiidae. Beyond this one cannot go with any degree of certainty, for while it would appear to be either *Cribropontius* or *Sestropontius,* the shape of the body is much more like that of *Cryptopontius.* The structure and size of the siphon also indicate this genus as does the claw of the maxilla, but inclusion in this genus requires that the fourth endopod should be absent. It is clear, however, that it does not belong to the Artotrogidae.

It is difficult to determine whether Brady's species *gigas* and *sphaericus* belong to *Artotrogus* or not. In spite of the pronounced sub-circular outline of the body, I am inclined to doubt that they should be included. It is clear that *sphaericus* is a female, and *gigas* must be presumed to be so, since the genital segment does not show the distinctive male characters. The latter species is inadequately described and figured, but in both this and *sphaericus* the urosome is too long, has too many segments, and the genital segment lacks the distinctive postero-lateral extensions found in *orbicularis* and *australis.* Further, in *sphaericus* the maxilla has the distal portion of the end claw distinct, and the whole claw is only slightly curved distally, whereas in *orbicularis* it is strongly curved and undivided. In both *orbicularis* and *australis* the siphon reaches the base of the maxillipeds, whereas in Brady's species it does not, but this may be of only minor importance. Brady's species *Dystrogus uncinatus* might have been accepted as an *Artotrogus,* but for his statement concerning the fourth legs, which excludes it from both this genus and from *Dystrogus.*

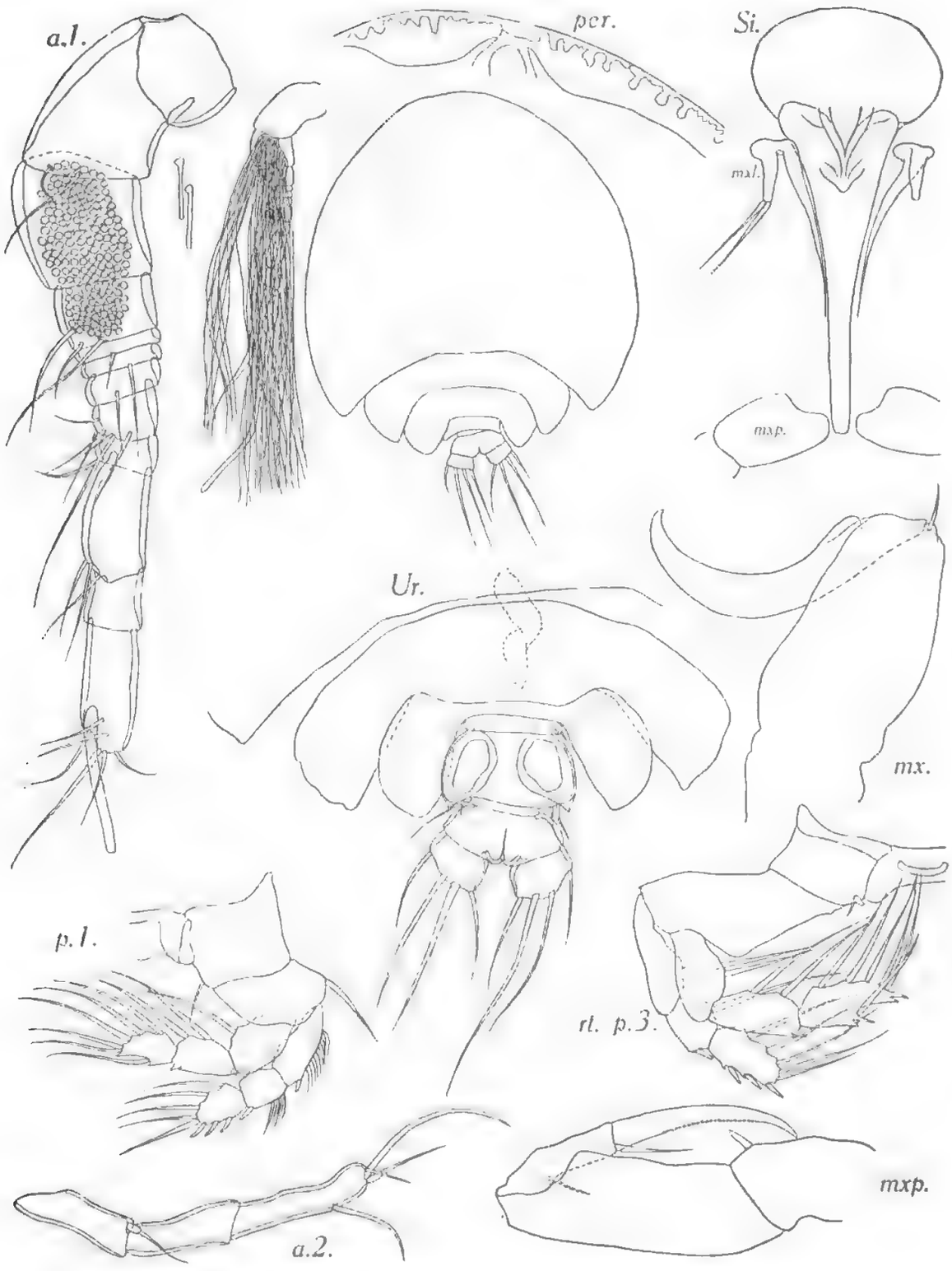

Fig. 19. *Artotrogus latifurcatus* sp. nov. Male × 35; urosome × 73; first and second antennae × 218; other figures × 131. The first antenna is shown also on a smaller scale (× 73) to illustrate the relative length of the sensory filaments, only 40 out of the total of 150 of which are shown. The bases of two of the filaments which have become detached are also shown (× 218). *per.* is portion of the anterior edge of the body seen from below (× 73).

Scott's species *proximus* must also be excluded from this genus on account of the well-developed fourth legs. It is difficult to place this species, which has certain affinities with *Bradypontius,* yet departs from that genus in several particulars. It is clearly a Dyspontiid.

Thus only two species are left: *orbicularis,* the type, and *australis* Wilson (1923). The latter was not fully illustrated since only a single specimen was obtained. According to Wilson it is distinguished from the type by "differences in the structural details of the two pairs of antennae, the first maxillae and the siphon" in addition to which it is twice the size of Boeck's species.

The species found here, a single male, is considerably smaller than Boeck's species, and is distinct from both his and Wilson's.

ARTOTROGUS LATIFURCATUS sp. nov.

Occurrence. XII, 1 male.

Male. Length, 1·37 mm.; width 1·24 mm. The body is sub-circular in outline with the caudal rami projecting beyond the posterior body margin. The urosome is composed of only three segments, the middle one of which is very short and narrower than either first or third. The third and fourth thoracic segments are fused, while the fifth is distinct but very short and without epimeral expansions; it bears a seta on each side representing the fifth legs. The genital segment is wider than long with two setae on each side of the hinder margin. The anal segment widens posteriorly to a greater extent even than in *australis.* The caudal rami are wider than long and bear only terminal setae.

The first antenna is composed of eleven segments, the fourth and fifth segments are very short, the sixth to eighth somewhat longer but shorter than any of the remaining segments. A large sensory filament is borne on the terminal segment and a great number of thin but much longer filaments are clustered together on the second and third segments. The position of these is indicated in the figure, but it was difficult to be certain of the total number. It was estimated that there were about one hundred on the second segment and fifty on the third. These filaments easily become detached, when it is found that they are swollen basally as shown in the figure. The second antenna is three-segmented, with the first two segments sub-equal and the third somewhat longer. A small exopod is borne distally on the basal segment and is armed with a single seta. The siphon is short but reaches to the base of the maxillipeds as in the other species. It is bluntly rounded as in *orbicularis.* The maxillule, maxilla and maxilliped are much as in the type species. The swimming legs have the following seta formula:

		endopod.	exopod.
p.1.		1.2.321.	1.1.323.
p.2.		1.2.321.	1.1.423.
p.3.	right	1.2.321.	1.1.323.
	left	1.1.321.	1.1.423.

The outer margin of the head segment (fig. 19, *per.*) shows a design similar to that shown for *Entomolepis* by Brady (1899) and for *Lepeopsyllus* by Thompson and Scott (1903).

Apart from its much smaller size than either of the two described species this differs from *orbicularis* in the elongate second antenna and in the armature of the distal segment of the third endopod. It differs from *australis* in that the siphon does not extend beyond the base of the maxillipds. Other points of difference are probably only sexual.

POECILOSTOMA.

One of the chief distinguishing features of this group of Cyclopoids, according to Sars (1917, p. 142), is the absence of any structures representing the mandibles of other copepods. He discusses this point at some length and states that the most anterior oral appendage is the maxilla (maxillule) bearing a palp which has been erroneously taken for an independent limb by other authors who have described them as mandible and maxillule. He points further to the resemblance between what he terms the maxilla in the families Clausidiidae and Cyclopidae; in the latter the mandible is always present but often without a palp, whereas the maxillule (his maxilla) always has a palp and is of similar structure to that found in the Clausidiidae. He admits, however, that "in a few cases this exopodite may assume a somewhat maxilla-like appearance."

In this connection I find myself in complete disagreement with Sars, at least as far as the Clausidiidae is concerned. The few specimens of *Hemicyclops* found in this collection have been dissected with particular attention as to whether these two anterior pairs of mouth parts came away together or were attached separately. In each case I found no attachment between them and during dissection observed that they were independently mounted side by side on the supporting skeleton. I am, therefore, convinced that there are two separate appendages: the mandible, which has the typical shape of such an appendage though lacking a palp and having a somewhat specialized armature and the maxillule, which is here distinctly cleft, the smaller lobe armed with strong spines representing the gnathobase, the larger lobe with setae only being the palp. Sars, in support of his view that there is only one appendage, the maxillule, states that "the said limbs are not placed, like the mandibles, at the side of that aperture (the mouth), but decidedly behind it, turning their extremities more or less forwards, precisely as do the maxillae in other Copepoda." While this may be true for the other Poecilostomous copepods, it obviously does not apply to the Clausidiidae, as can be seen at once by an examination of Sars' figures for the oral area in both *Hemicyclops purpureus* and *Hippomolgus furcifer* (pl. lxxxi, lxxxii). My own figure for the oral area of *Hemicyclops australis* (fig. 21), described below, agrees closely in the arrangement of the parts with those given by Sars, as does also the figure of *Goidelia* given by Embleton (1901, pl. 22, fig. 10). Sars' figures differ from those of Embleton and myself only in having the maxillule attached to the base of the mandible.

As mentioned above, Sars admits the "maxilla-like appearance" of what he regards as the "palp or exopodite" of "the foremost pair of limbs" and points out its resemblance to that appendage in some of the Cyclopidae. The best answer to this is supplied by Sars himself in his figure for *Hippomolgus furcifer* (pl. lxxxii, *m*). Here, according to his interpretation, we see a maxillule with a palp attached basally. In the Cyclopidae (cf. Sars, pl. xii-xvi, xliii, xlviii, and l) the palp is always attached to the *distal* portion of this appendage.

Gurney (1927, p. 464) has discussed this question and concludes that "neither the structure nor the position of these appendages is inconsistent with their interpretation as mandibles." While I share the hesitation expressed by Dr. Gurney in differing from "an authority of such eminence and accuracy as Prof.Sars," it would certainly appear that Sars has drawn the mandible and maxillule together as a single appendage. Even if these two appendages were really parts of the same appendage it would seem more reasonable to interpret that appendage as the mandible, with a proximally inserted palp, as has been done by Wilson (1932a) and Light and Hartman (1937). As Embleton (*loc. cit.*) has shown in *Goidelia* it is the maxillule which has undergone the greatest reduction.

Wilson (1932a, pl. 5 C) figures a mandible, with palp, for *Hemicyclops americanus*, though he does not mention such an appendage in the text (p. 45); here he describes the "first maxilla" from which it is apparent that he is referring to the structure labelled "mandible" in the plate. For *H. thysanotus*, Wilson (1935) describes a mandible (p. 764) and figures its palp (fig. 44), without reference to the maxillule. For *H. callianassae*, described in the same paper, no reference is made to these mouth parts. It is to be assumed, however, that Wilson interprets as mandible and palp what Sars regarded as maxillule and palp.

Light and Hartman (1937) have figured the "mandible" of *H. puggettensis* with the "palp removed" (p. 177, fig. 17) and in the text (p. 181) they describe the "palp" but make no mention of a maxillule; this is in conformity with their statement (p. 180) that "The genus *Hemicyclops* is characterized by the presence of a well-developed mandibular palp." and yet, in their description (p. 176) of *Clausidium vancouverense* (Haddon, 1912) both mandible and maxillule are recognized and described. From their descriptions it is clear that these appendages have a structure similar to those of other members of the family and are correctly interpreted as mandible and maxillule.

Leigh-Sharpe (1939) in his re-description of *Hersiliodes pelseneeri* Canu regards the mandible and maxillule as separate appendages and describes the maxillule as biramous, which is in conformity with the view already expressed by Gurney and upheld here.

Thus it may be asserted that the Clausidiidae depart from Sars' definition of the Poecilostoma in that a distinct mandible is present. But Gurney (*loc. cit.*) goes further, and states that in other Poecilostomous cyclopoids, even in the Lichomolgidae, the mandible and its "palp" are separable and can be recognized as distinct appendages. His figure of *Thersitina gasterostei* (Gurney, 1913, pl. xi, fig. C) shows an arrangement of mouth parts similar to that given below for *Hemicyclops*.

This view is supported by the figure of the oral region of *Paranthessius propinquus* sp. nov. given below (fig. 24), in which although the mandible and maxillule could not clearly be traced back to their points of attachment, there did not appear to be any obvious insertion of the maxillule on the mandible as a "palp".

FAMILY CLAUSIDIIDAE Embleton.

Embleton, 1901.

Originally named the Hersiliidae Canu (1888) it was first shown by Embleton (1901) that *Hersilia* (Phil. 1839) had been twice preoccupied. Kossmann (1874) had described a species of *Hersilia* under the name *Clausidium* and Embleton therefore substituted Kossmann's name for Philippi's and established the family under Kossmann's name.

There would not appear to be any justification for the introduction of a new name for *Hersilia* by Strand (1914), who proposed to replace it by *Pseudohersilia*, which name therefore becomes a synonym of *Clausidium*. Sars (1917, p. 145) has shown that *Platucheiron* T. and A. Scott (1892) is a synonym of *Hemicyclops*. As will be shown below the genus *Saphirella* T. Scott (1894) representing, as already pointed out by several authors, the immature stage of a Clausidiid, is a synonym of *Hemicyclops*. *Goidelia* Embleton (1901) was placed in this family, but it is with considerable doubt that I have included it, differing as it does in several important features, particularly the prehensile second antenna.

In view of the difference of opinion regarding the interpretation of the mouth parts, and with the inclusion of *Goidelia*, it will be necessary here to give a new diagnosis of the family.

First thoracic segment fused with the cephalon; urosome 4- or 5-segmented in the female; 5-segmented in the male. First antenna 5- to 7-segmented. Second antenna usually armed only with setae. Labrum short and broad, fringed with fine spinules. Mandible reduced, without a palp and armed always with one terminal claw with or without accessory pieces which are never more than three in number. Maxillule bilobed, the smaller inner lobe armed with spines, the outer lobe with setae only or reduced to a single lobe armed only with setae. Maxilla short and stout, 2-segmented, the proximal segment armed with simple spines, the distal segment with two strong claw-like spines. Maxillipeds reduced and scarcely prehensile in the female but well-developed and strongly prehensile in the male. Swimming legs usually of normal structure, though showing a peculiar modification of the first pair in *Clausidium*. Fifth legs lamellar, one- to three-segmented. The following genera are included:

HEMICYCLOPS Boeck.

Hemicyclops Boeck, 1873.
nec *Hemicyclops* Claus, 1893.
Platycheiron T. and A. Scott, 1892.
Saphirella T. Scott, 1894.
Saphirella Wolfenden, 1905.
Hemicyclops Sars, 1917.
Saphirella Sewell, 1924.
Hemicyclops Light and Hartman, 1937.

CLAUSIDIUM Kossmann.

Binoculus Say, 1818.
Hersilia Philippi, 1839.
Clausidium Kossmann, 1874.
Clausidium Embleton, 1901.
Clausidium Light and Hartman, 1937.

HERSILIODES Canu.

Hersiliodes Canu, 1888.
Hersiliodes Bourne, 1890.
Hersiliodes Thompson and Scott, 1903 (pro parte).

H. dubia Thompson and Scott (1903) is clearly a *Hippomolgus*, the only male so far described for this genus.

GIARDELLA Canu.

Giardella Canu, 1888.
Giardella A. Scott, 1906.

GOIDELIA Embleton.

Goidelia Embleton, 1901.

HIPPOMOLGUS Sars.

Hersiliodes Thompson and Scott, 1903 (pro parte).
Hippomolgus Sars, 1917.

KEY TO THE GENERA.

1. First legs modified into sucking organs .. .. *Clausidium* Kossmann 1874.
   First legs normally developed .. .. 2.
2. Second antenna prehensile, armed with claws; fifth legs three-segmented *Goidelia* Embleton 1901.
   Second antenna non-prehensile, armed only with setae; fifth legs one- or two-segmented .. 3.
3. Fifth leg one-segmented .. .. 4.
   Fifth leg two-segmented .. .. 5.
4. First antenna short and compact .. .. .. *Hippomolgus* Sars 1917.
   First antenna long and slender .. .. .. *Hersiliodes* Canu 1888.
5. Mandible armed with one claw and two hooks .. .. *Giardella* Canu 1888.
   Mandible armed with one claw, one toothed plate, and two setae *Hemicyclops* Boeck 1873.

Genus HEMICYCLOPS Boeck.

Sars, 1917, p. 145; Light and Hartman, 1937.

A key to the species of this genus has been given by Light and Hartman, who have discussed the genus and give reasons for excluding the two species *Hersiliodes*

puffini Thompson 1887, and *H. thompsoni* Canu 1888, which Sars (1917, p. 145) considered should be transferred to *Hemicyclops*. *H. elongatus* Wilson (1937) was described in the same year as Light and Hartman's review and so was not included in their key.

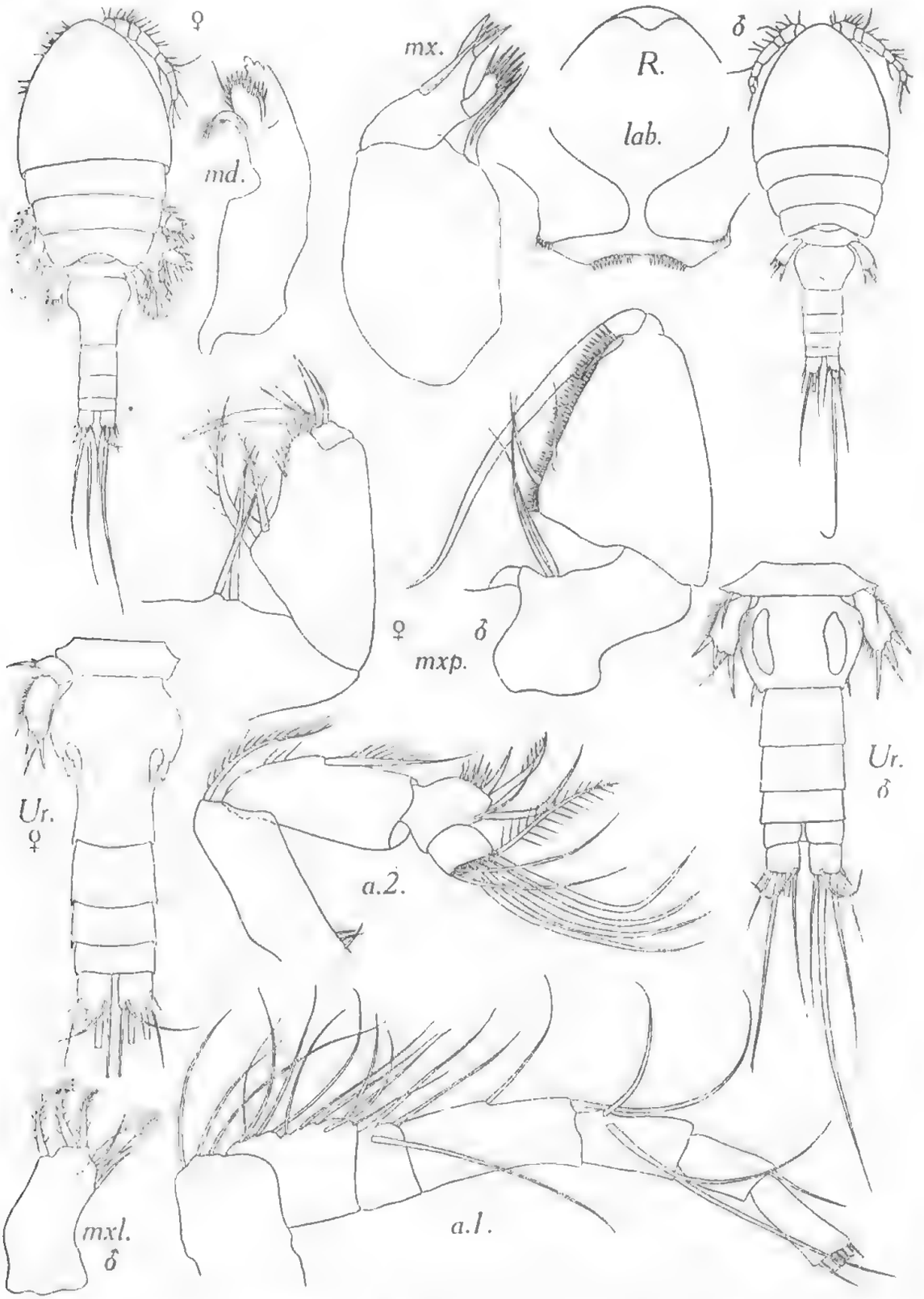

Fig. 20. *Hemicyclops australis* sp. nov. Male and female × 38; rostrum, and urosome, both sexes, × 80; appendages × 240.

HEMICYCLOPS AUSTRALIS sp. nov.

Occurrence. IX, 1 female, 1 male; XI, 2 females, 1 male.

Female. Length 1·38 - 1·40 mm. The body has the usual shape and proportions found in the genus; the genital segment is swollen and rounded anteriorly with lateral projections behind the swollen portion, and is longer than the rest

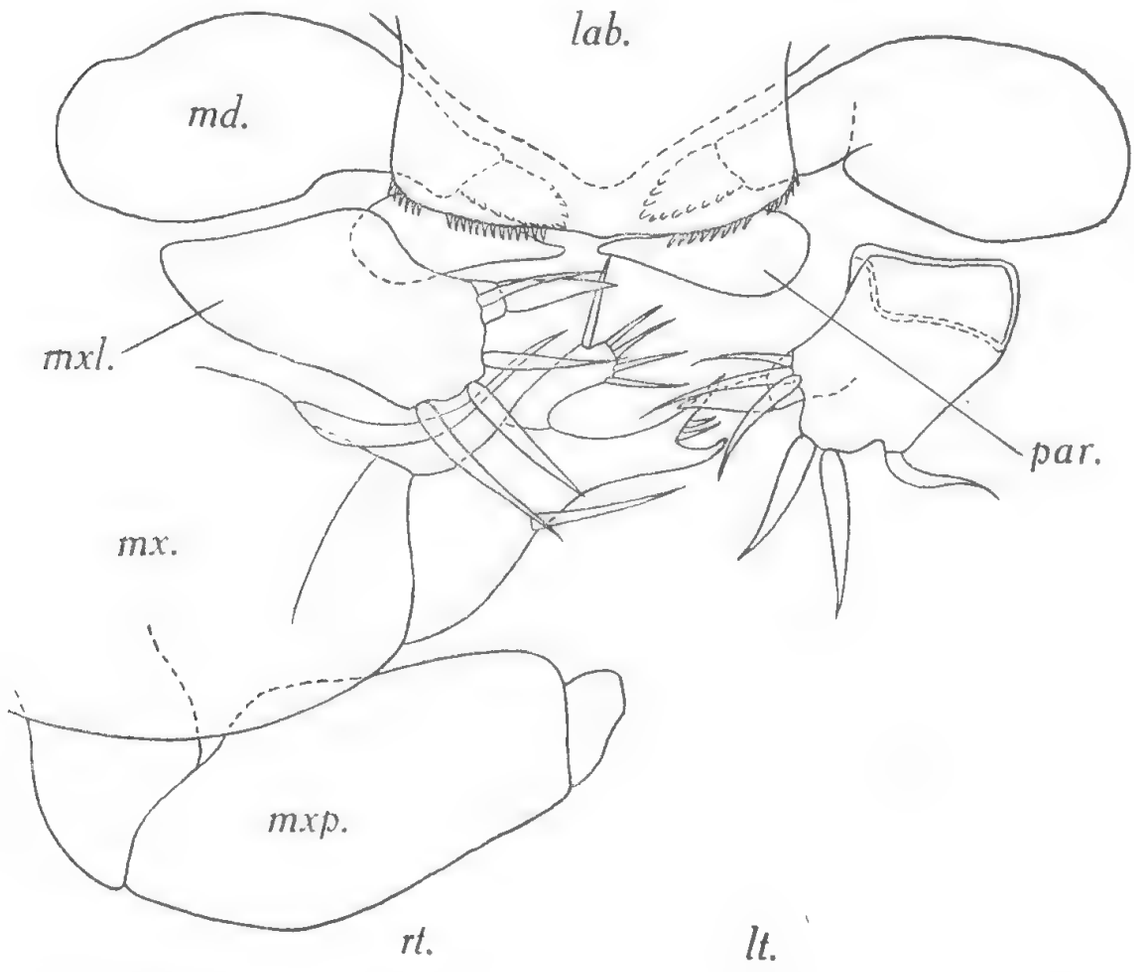

Fig. 21. *Hemicyclops australis* sp. nov., oral area seen from below × 450. In the process of dissection the left maxilla and maxilliped were removed, and the maxillule slightly displaced posteriorly from its natural position. On this side the base of this appendage and its position of attachment are clearly seen. On the right side the appendages occupy their normal positions. It is of interest to note that paragnaths (*par.*) are present and that the mandible and maxillule are distinct appendages.

of the urosome; the anal segment is the shortest; the caudal rami are sub-rectangular, almost as wide as long and longer than the anal segment. The first antenna is 7-segmented; the second antenna has the two proximal segments long and sub-equal, the third segment is short and has a lateral swelling, and the terminal segment is short and sub-rectangular, wider than long. The upper lip is of a distinctive shape and armed with marginal spines; the mandible is armed with a large terminal toothed "claw," a wide lamellar toothed plate and two setae, one of which is strongly built, the other much more slender; the maxillule is clearly bilobed, the inner lobe bearing a strong spine and three setae, the outer armed only with setae; the maxilla is two-segmented, the basal segment bears a long double

spine distally and the end segment has a large terminal claw and accessory seta, and a small inner branch armed with spines. The maxilliped is three-segmented, the basal segment armed with two long setae, the second with an inner projection or bulge bearing two spinous setae, and the terminal segment bears two unequal claws and some setae. The swimming legs are of the usual structure with the following seta formula:

	endopod.	exopod.
p.1.	1.1.51.	0.1.62.
p.2.	1.2.33.	0.1.54.
p.3.	1.2.24.	0.1.54.
p.4.	1.2.14.	0.1.53.

The setae and spines are arranged in a more or less continuous series around the margins of the distal segments of these legs so that it is difficult to decide how many are terminal and where the inner and outer begin or end. No attempt has been made to express the distribution of the setae on the end segments in the formula, the figures refer to the number of setae and spines respectively. On the end segment of the third exopod the figures given are 54, but on the other leg of that pair there were five setae, but only three spines. The fifth leg is two-segmented, the basal segment armed with a short seta and the distal segment with one spine and one seta terminally and two outer lateral spines.

Male. Length 1·17 - 1·20 mm. The body is like that of the female, but the urosome is five-segmented. At the postero-distal corners of the genital segment there is a spine representing the sixth legs. The only appendage showing any difference from the female is the maxilliped which, as usual in this group, is much more strongly prehensile than that of the female. The terminal claw is much longer and more strongly developed and the whole of the inner edge of the middle segment is armed with a series of short stout spines; this segment is roughly triangular in shape due to the greater development of the inner prominence found also in the female. The seta formula for the swimming legs is like that of the female.

This species resembles *callianassae* Wilson (1935) and *purpureus* Boeck (Sars, 1917) in having the genital segment undivided, though in the former this segment is no longer than the preceding segments. It further resembles *purpureus* in the comparatively short caudal rami. It is distinguished from this species, however, by the structure of the second antennae in which it resembles *pugettensis* Light and Hartman (1937) and *thysanotus* Wilson (1935) in having the third segment swollen and laterally produced, though without the distal extension found in these species and so noticeable in *thysanotus*.

Further, in the proportional lengths of the third and fourth segments of the second antenna, when compared with the second segment, it resembles *aberdonensis* T. and A. Scott (1892), and with this species is distinguished from others in the genus by this feature. It differs from *elongatus* in the genital segment and caudal rami, which are four times as long as wide in the latter. (The second antennae have not been described for *elongatus* Wilson (1937)).

"SAPHIRELLA" and "PAUROCOPE"

It appears to be a characteristic feature of the members of the Clausidiidae that some of the mouth parts show very little, if any, alteration during the post-larval development. Canu (*fide* Embleton, *op. cit.*, p. 219) found that the mouth parts are not altered by the various moults, and Embleton states for *Goidelia japonica* that "The form of the mandible . . . is constant for the adult and immature stages of both sexes" and that the maxillules are "alike in all stages and both sexes." In *Goidelia*, unlike the other members of the family, both the maxilla

and maxilliped are strongly developed and show sexual differences. The maxilla in the female and maxilliped in the male are specialized for prehension and alter during development, and conversely, the maxilla in the male and maxilliped in the female are less developed and show little or no change in development.

In attempting to place the genera *Saphirella* and *Paurocope,* therefore, one would expect to find the clue to their adult forms in the mandibles and maxillules.

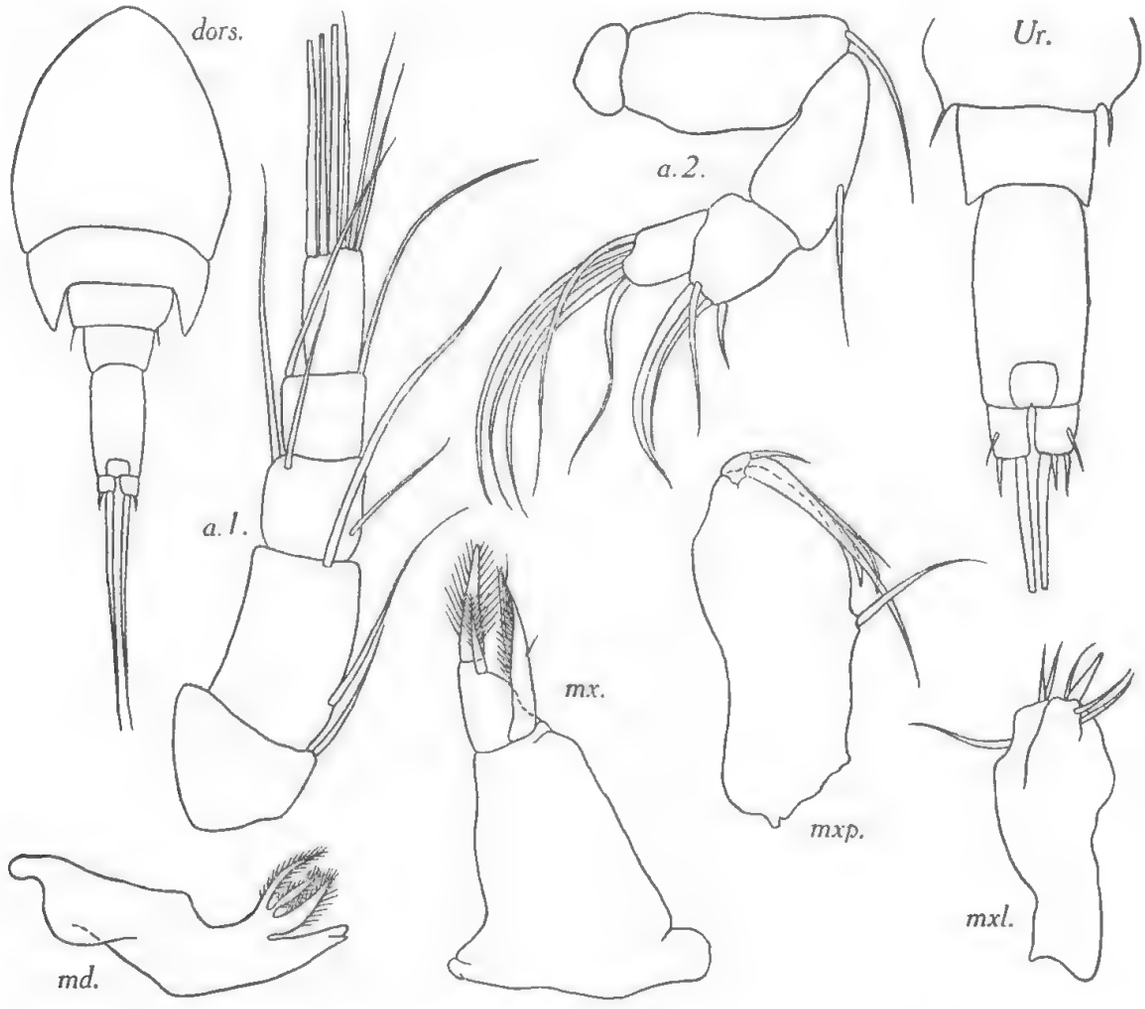

Fig. 22. *"Saphirella" tropica* Wolfenden = *Hemicyclops* sp., juvenile. Dorsal view × 48; urosome × 100; appendages × 300.

In studying the plankton collected by the C. S. and I. R. Fishery Research vessel "Warreen" I have encountered a single specimen of a copepod apparently referable to *Saphirella* and most closely resembling Wolfenden's species *tropica.* I am indebted to Dr. H. Thompson, Chief of the Division of Fisheries, for permission to include a description of this specimen here. As can be seen from a comparison of the respective figures for *"Saphirella tropica"* and *Hemicyclops australis,* described above, the mandible and maxillule show the same structure. The terminal claw of the mandible is more nodular in the adult and the toothed plate more robust. In the maxillule both parts and all the armature found in the adult are represented in the immature form. Unfortunately, this appendage was mounted so that the two lobes overlap one another in the immature form, but the corresponding parts can clearly be made out. The maxilla and maxilliped are not so fully developed as in the adult, but from the structure of the latter appendage

in the immature form it would appear that the specimen was a female. One of the more striking features of this immature specimen is the structure of the second antenna, which clearly shows the lateral expansion of the third segment so characteristic of several species of *Hemicyclops*. The first antenna shows only five segments instead of the full number of seven.

Before definitely identifying *Saphirella* with *Hemicyclops* it should be noted that two other genera have a mandible similarly armed. Embleton (*op. cit.*, p. 214, 215) quoting Canu, shows that in *Hersiliodes* there are three accessory parts to the mandible in addition to the terminal claw, and Sars (1917, pl. lxxxii) shows a similar structure for the mandible of *Hippomolgus*. In the former, in addition to the claw and blade, there are "two long bearded flexible hooks" or "setae," whereas in *Hemicyclops* and *Hippomolgus* these two setae are short, no longer than the claw and blade. In the latter genus the maxilliped and its armature are greatly reduced in the female though strongly prehensile in the male (cf. *H. dubia* (Thompson and Scott) 1903, pl. iii, fig. 24) in conformity with the characters of the family. It is clear, therefore, that in *Saphirella* we have the young form of *Hemicyclops*.

Concerning *Paurocope* Brady (1899), Sewell (1924, p. 800) attempts to show that it may be synonymous with *Saphirella*, but I cannot entirely agree with his interpretation of Brady's figures.

We know that in one genus (*Goidelia*) the mandible may be armed with a single terminal claw. Brady's fig. 5 (pl. xiii) may truly represent the mandible as claimed by him. His fig. 6, which he calls the maxilla (maxillule) is certainly not that appendage but might be either the terminal portion of the maxilla or, more likely, the end of the mandible showing the terminal claw with three accessory pieces (in this case two toothed blades and one seta) typical of three out of the six known genera. His fig. 7 is unrelatable to any other recognizable mouth part, though the terminal portion might represent the maxillule as suggested by Sewell (*loc. cit.*). The proximal portion bears no relationship to any of the mouth parts known for this family. It seems probable to me, therefore, that *Paurocope* does represent a distinct genus, and since I cannot relate it to any of the known genera I regard it as representing the immature stage of a seventh member of the Clausidiidae, the adult of which is so far unknown. This view gains some support from a comparison of the published figures of the whole animal in dorsal view. Compare T. Scott, 1894, pl. xiii, fig. 57; Wolfenden, 1905, pl. xcix, fig. 12; T. Scott, 1921, pl. iv, fig. 2; Sewell, 1924, pl. lix, fig. 1; and the figure given here. In every case the first free thoracic segment shows strong lateral posterior projections, reaching at least half-way to the hinder margin of the following segment in *indica* and right to the posterior margin of that segment in every other case. Compare these with *Paurocope* and it will be seen that Brady shows very little, if any, posterior extension to this segment.

"SAPHIRELLA" TROPICA = HEMICYCLOPS sp.

Wolfenden, 1905, p. 1,030.

Occurrence. C.S.I.R. Station 204/39, 24/7/39, 50-0 Vertical net, 32° 18′ S., 152° 24′ E.

Distribution, Indian Ocean.

Immature specimen. Length 1·06 mm. This copepod has already been discussed above; a detailed description of the mouth parts would merely be repetitive of what has already been said for *Hemicyclops australis*. Only two pairs of legs were present, each with one-segmented rami, a third pair was represented by spines only. The figure is included here (fig. 22) so that comparison can be made with previous descriptions and with the species of *Hemicyclops*.

FAMILY LICHOMOLGIDAE Claus.

Claus, 1889, p. 328; Sars, 1917, p. 149; Gurney, 1927, p. 463.

Claus associated a number of similar genera under this heading; Sars defined the family and added further genera and later authors hav since contributed additional genera. Gurney has suggested that the group should be divided into two sub-families according to the segmentation of the fourth endopod.

SUB-FAMILY SABELLIPHILINAE Gurney.

Gurney, 1927, p. 463.

Lichomolgidae in which the fourth endopod is three-segmented. One genus is represented in this collection.

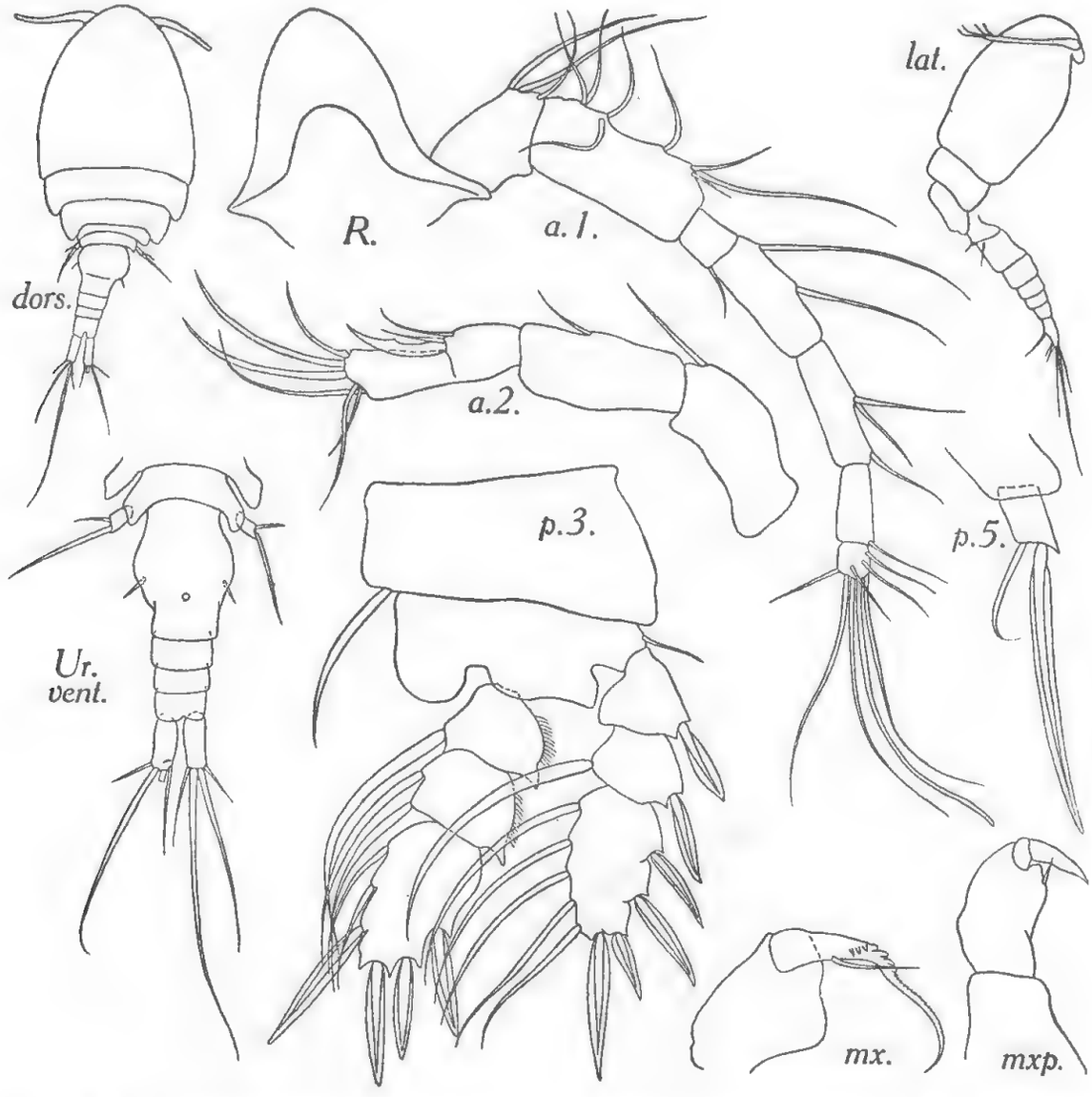

Fig. 23. *Paranthessius propinquus* sp. nov. Female × 38; urosome × 80; appendages × 240.

Genus PARANTHESSIUS Claus.

Claus, 1889; Monod and Dollfus, 1932, p. 143.

Monod and Dollfus (*loc. cit.*) state that *Herrmannella* Canu (1891) is synonymous with this genus. While I am not entirely in agreement with them, I am not sufficiently familiar with the group to question their conclusion, and have contented myself with comparing the species found here with all those species which have been identified as belonging to either of these genera (with the exception of *H. rostrata* Canu 1891, *H. cynthiae* Brian 1924, and *Heteranthessius dubius* (T. Scott) 1903, and *Pestalichomolgus pectinis* (Pesta) 1908, the two latter also being included in *Paranthessius* by these authors, since the literature in each case has not been available to me).

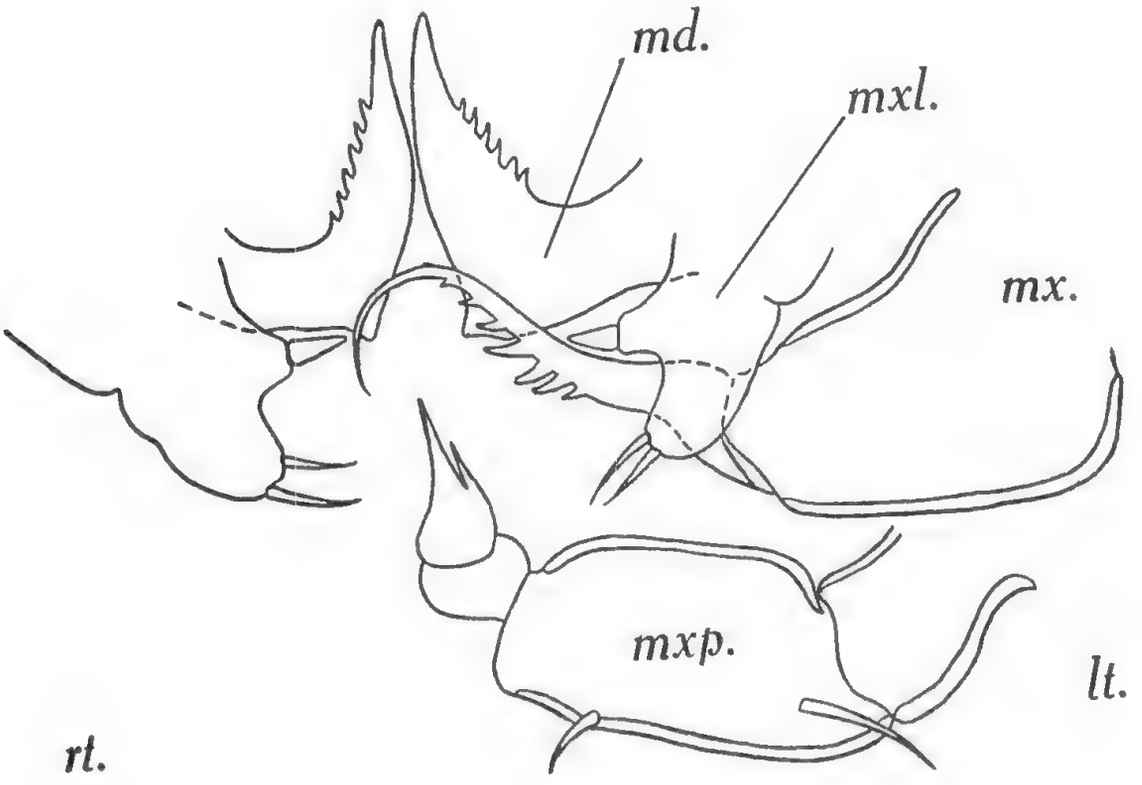

Fig. 24. *Paranthessius propinquus* sp. nov. Mouth parts *in situ* seen from below. (× 565).

The species found here would appear, with these reservations, to be distinct, and I have therefore described it as a new species.

PARANTHESSIUS PROPINQUUS sp. nov.

Occurrence. IX, 2 females.

Female. Length 1·02 – 1·06 mm. The body is of the usual shape in this genus, with a well-developed rostrum ventrally. The urosome is composed of four segments, the genital segment comprising half the urosome, including the caudal rami. These are about two and one-half times as long as wide, and as long as the anal and pre-anal segments together. The first antenna is 7-segmented and of the usual form; the second antenna consists of four segments, the first two large and sub-equal, each with a single lateral seta, the third segment is short and bears a distal curved spine and two setae, and the end segment bears six terminal

setae. The mouth parts are normal; the mandible and maxillule were lost in the first dissection but are shown in the figure of the oral region. In the seta formula for the legs the distribution around the terminal segments is not shown, but the figures indicate the total number of setae and spines respectively on these segments:

	endopod.	exopod.
p.1.	1.1.51.	0.1.44.
p.2.	1.2.33.	0.1.54.
p.3.	1.1.24.	0.1.54.
p.4.	1.1.14.	0.1.53.

The fifth leg consists of a single segment, half as long again as wide, with its inner distal corner produced into a pointed process and armed terminally with one long, bladed spine and a shorter seta.

SUB-FAMILY LICHOMOLGINAE Gurney.

This group contains those genera in which the fourth endopod is reduced to two or fewer segments, sometimes being absent.

Genus PSEUDANTHESSIUS Claus.

Claus, 1889, p. 344; Sars, 1917, p. 166.

The synonymy of this genus has been discussed by Gurney (1927, p. 463) and by Monod and Dollfus (1932, p. 139). It need only be added that *P. fucicolus* T. Scott (1912) should be transferred to Gurney's genus *Kelleria*, which he established (1927, p. 470) for "certain species in which the endopod of leg 4 is one-jointed, but with an inner seta and a notch in the position of the joint in *Lichomolgus*, and with a freely movable 5th leg" (*op. cit.*, p. 463). The following species remain in this genus: *liber and thorelli* (Brady and Robertson) 1875; *gracilis* Claus 1889; *sauvagei* Canu 1891; *concinnus* Thompson and Scott 1903; *obscurus* and *weberi* A. Scott 1909; *assimilis* Sars 1917; *dubius* Sars 1918; *mucronatus* Gurney 1927; *nemertophilus* Gallien 1935.

The species found here can be identified with none of these and so must constitute a new species.

KEY TO THE SPECIES.

1. Outer margin of the fourth endopod entire .. .. 2.
   Outer margin of the fourth endopod broken by a swelling or indentation which may become a conspicuous knob or notch .. .. 3.
2. Caudal rami twice as long as wide, little longer than the anal segment *liber* (Brady and Robertson) 1875.
   Caudal rami three times as long as wide, one-third as long again as the anal segment *assimilis* Sars 1917.
3. Caudal rami twice as long as wide .. .. .. *sauvagei* Canu 1891.
   Caudal rami more than twice but not more than four times as long as wide .. .. 4.
   Caudal rami more than four times but not more than six times as long as wide .. 6.
   Caudal rami at least ten times as long as wide .. .. 7.
4. Fourth endopod with marked notch at proximal third; segments of first antenna short and compact; genital segment not greatly dilated .. .. *obscurus* A. Scott 1909.
   Fourth endopod with notch or constriction at centre; segments of first antenna normal; genital segment considerably dilated .. .. 5.
5. Second thoracic segment with posterior projections; fourth endopod no longer than basal segment of exopod, with proximal bulge but no notch .. *mucronatus* Gurney 1927.
   Second thoracic segment without posterior projections; fourth endopod longer than basal segment of exopod and with a distinct notch .. .. *tenuis* sp. nov.

6. Fourth endopod with marked notch at about centre; caudal rami six times as long as wide *gracilis* Claus 1889.
   Fourth endopod with slight notch at centre and proximal bulge; caudal rami five times as long as wide .. .. *weberi* A. Scott 1909.
   Fourth endopod without notch, but with slight proximal bulge; caudal rami four to four-and-one-half times as long as wide .. .. *nemertophilus* Gallien 1935.
7. Last two segments of urosome subequal .. .. 8.
   Anal segment at least twice as long as pre-anal .. *thorelli* (Brady and Robertson) 1875.
8. Caudal rami about as long as last two segments of urosome together *dubius* Sars 1918.
   Caudal rami about as long as last three segments of urosome together *concinnus* Thompson and Scott 1903.

PSEUDANTHESSIUS TENUIS sp. nov.

Occurrence. IX, 1 female.

Female. Length 0·66 mm. Body of usual shape in the genus, with the genital segment distinctly dilated anteriorly, bearing a pair of pointed postero-lateral

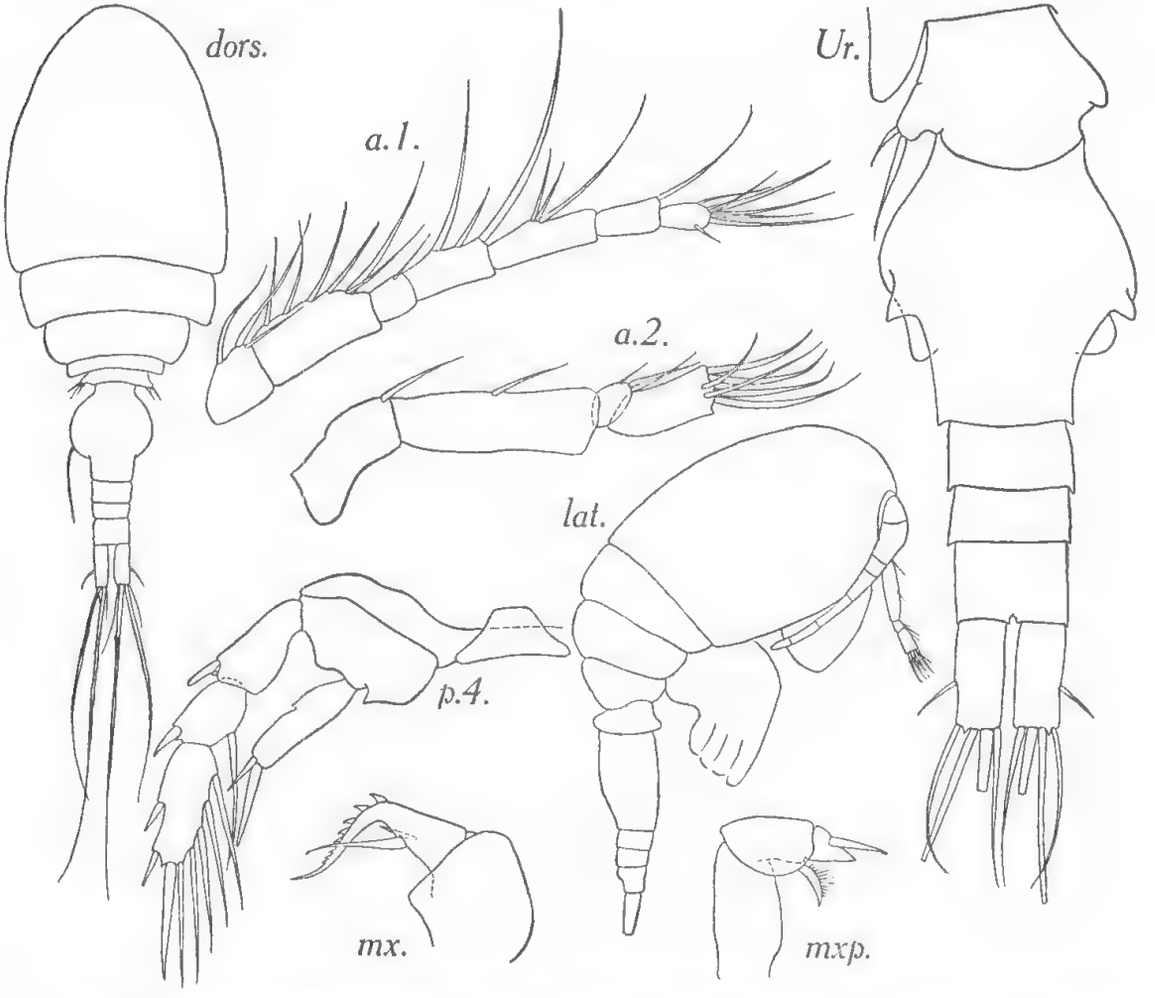

Fig. 25. *Pseudanthessius tenuis* sp. nov. Female × 80; urosome and appendages × 240.

projections dorsally at about the centre and a pair of rounded projections ventrally, just behind the dorsal projections. The anal segment is longer than the pre-anal, but not as long as the caudal rami, which are distinctly more than twice as long as wide. The first antenna is 7-segmented and of normal appearance; the

second antenna has an elongate second segment, a very short third segment and a moderately long end segment bearing four long spines and two setae. The mandible and maxillule were not seen; the maxilla and maxilliped resemble those of *gracilis* Claus as shown by Sars (1917, pl. xciii). The swimming legs have the following seta formula:

	endopod.	exopod.
p.1.	1.1.321.	0.1.323.
p.2.	1.2.321.	0.1.423.
p.3.	1.2.221.	0.1.423.
p.4.	020.	0.1.422.

The one-segmented fourth endopod has two unequal terminal spines; the fifth legs are immobile rounded knobs, tipped with two setae, typical for the genus.

Male unknown.

This species approaches most closely to Gurney's species *mucronatus,* from which it differs in a number of points: the body is more slender, the thorax is without hooks, and the fourth somite is distinct and not overlapped by the third; the genital segment is longer than wide, the caudal rami are not more than two-and-one-half times as long as wide and the terminal setae are distinctly longer than the urosome; the first antenna is nearly as long as the cephalosome; the third and fourth segments of the second antenna are quite unequal and the end segment bears four setiform claws; the endopod of the fourth leg is distinctly notched and the fifth leg bears only two setae.

MONSTRILLOIDA.

FAMILY MONSTRILLIDAE.

Genus MONSTRILLA Dana 1848

Sars, 1921a, p. 10.

There are some twenty-one species of *Monstrilla* which have been described; of these I have been unable to compare this species with the descriptions of *canadensis* McMurrich 1917, *conjunctiva* Giesbrecht 1902, *intermedia* Aurivillius 1898, *longispinosa* Bourne 1890, *ostroumowi* Karaviev 1895, and *wandelii* Stephensen 1913. It appears in the structure of the fifth leg to approach most closely to *mixta* T. Scott 1914, but differs in having only two setae instead of three here, and further, in the much shorter length of the setiform appendage on the genital segment and in the first antenna; the shape of the cephalic segment is also different. Scott compares his form with Giesbrecht's *conjunctiva,* described from a male, but this is one of those species with which I have been unable to make any comparison. The probability is that it is an undescribed species, but with so many descriptions unavailable I hesitate to name this as a new species.

MONSTRILLA sp.

Occurrence. III, 2 females (1 damaged); length 3·38 mm.

NOTODELPHYOIDA.

Sars divides this sub-order into seven families, the last of which is the monotypic Anomopsyllidae. This family is included in the sub-order only provisionally by Sars, owing to the extraordinary reduction of the appendages. Its chief affinities with the Notodelphyoida lie in the manner in which the eggs are carried in a dorsal brood pouch. The single member of this sub-order found in this collection would appear to belong to this family, but it is quite distinct from the only

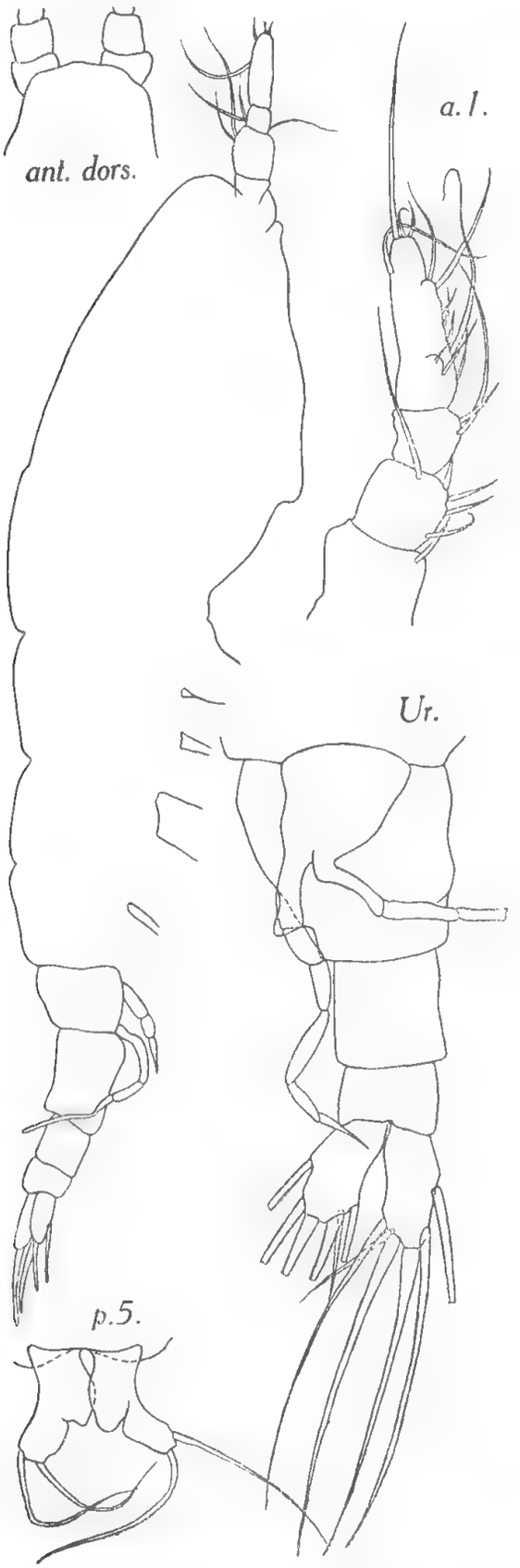

Fig. 26. *Monstrilla* sp., female. Side view and head × 35; urosome and appendages × 73.

genus so far described, *Anomopsyllus*. The reduction in the appendages found in this genus is carried almost to an extreme in the specimen found here, which is a mature female with eggs.

FAMILY ANOMOPSYLLIDAE Sars.

Sars, 1921a, p. 81.

No separate family diagnosis was given by Sars, since only the one species, *Anomopsyllus pranizoides*, was known and the family could only have the charac-

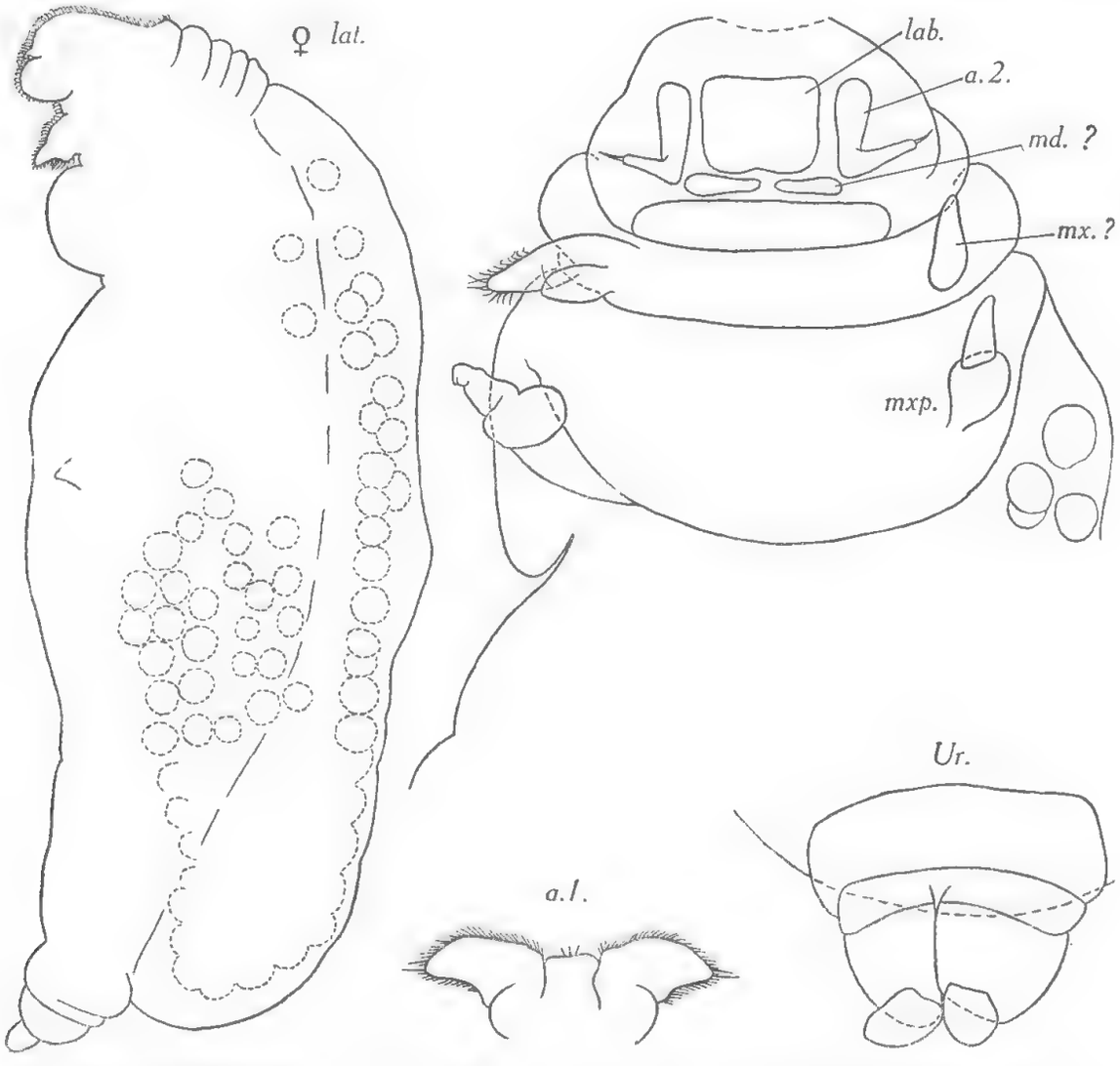

Fig. 27. *Dysgenopsyllus reevesbyensis* gen. et sp. nov. Female × 48; other figures × 100.

ters of the genus. An attempt is made here to define the family, based on characters common to both genera. The males are unknown.

Body divided into three regions, more or less sharply defined; the trunk composes most of the body and is unsegmented, the head is a small anterior region and the urosome a narrow two- or three-segmented posterior portion. The head appendages are greatly reduced, though some of the anterior ones may be segmented; the legs are reduced to small unsegmented triangular processes, quite unarmed. Caudal rami are present, but their armature may be reduced.

DYSGENOPSYLLUS REEVESBYENSIS gen. et sp. nov.

Occurrence. XV, 1 female.

Female. Length 2·35 mm. The body has the characters of the family. The first antenna is reduced to an unsegmented process fringed with fine hairs. The second antenna is two-segmented and armed with a single, terminal, slightly clawed spine; this is the most fully developed appendage on the body. There appears to be a large plate-like upper lip, with a pair of mandibles lying just behind it; maxillules could not be identified. The maxilla and maxilliped appear as segmented processes armed only with fine hairs. One pair of legs is present as small triangular processes like those of *Anomopsyllus*. The urosome is three-segmented, with the middle segment very short; the caudal rami are lobular unarmed processes.

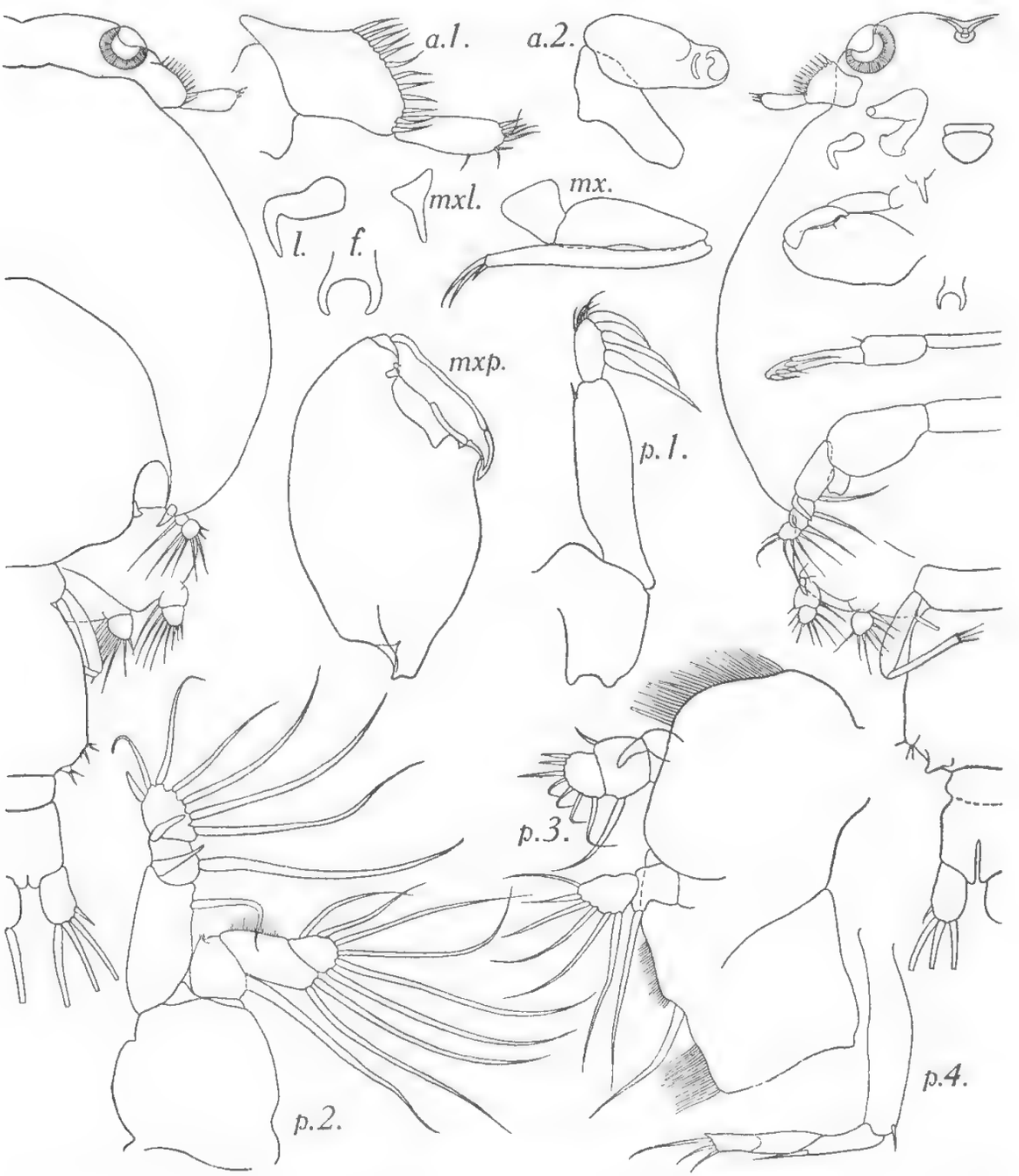

Fig. 28. *Caligus* sp., male. Dorsal and ventral views × 38; appendages × 80. *f.*, furca; *l.*, lateral hook.

This very inadequate description summarizes all that could be made out from the single specimen available. Apart from the removal of the first antennae the specimen has not been dissected.

The generic name, for the suggestion of which I am indebted to Professor G. Wood, of the Department of Classics and Ancient History at this University, is intended to indicate the degenerate condition of this animal.

CALIGOIDA.

FAMILY CALIGIDAE.

CALIGUS sp.

Occurrence. XVI, 1 male, 2·83 mm.

So much of the literature required for the identification of this species is not available to me that I have made no attempt to identify it beyond comparing it with the species included in Wilson's (1905) key to the genus. From this it would appear to approach most closely to *tercs* Wilson (1905), but it is certainly not identical with that species. I have given full illustrations of the specimen found here in the hope that others more familiar with the group will be able to identify it.

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LIST OF SAMPLES AND CONTENTS.

I. Smith Bay, Kangaroo Island; 15/3/38.

Calanopia thompsoni A. Scott.

II. Western Shoal, Spencer Gulf; 20/2/38.

Calanopia thompsoni A. Scott.
Tortanus barbatus (Brady).
Labidocera cervi Kramer.
Longipedia australica Nicholls.
Peltidium speciosum Thompson and Scott.

III. Blanche Harbour, Spencer Gulf; 8/3/38.

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Pseudophaenna sp.?
Gladioferens inermis sp. nov.
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Calanopia thompsoni A. Scott.
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IV. Wallaroo Harbour, Spencer Gulf; 26/2/38.

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V. Eastern Shoal, Spencer Gulf; 4/3/38.

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VI. Salt Lake, Beachport.

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VII. Moonta Bay, Spencer Gulf; February, 1939.

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Peltidium proximum Nicholls.
P. speciosum Thomp. and Scott.
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VIII. Port Willunga; 17/1/37.

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IX–XIII. Sellick Reef; 31/1/37–April, 1939.

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Calanopia thompsoni A. Scott.
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P. speciosum Thomp. and Scott.
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P. acuticaudatum Thomp. and Scott.
P. australe Brady.
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Eudactylopus australis Nicholls.
Phyllothalestris mysis (Claus).
Amphiascopsis longipes Nicholls.
A. australis Nicholls.
Amphiascoides intermixtus (Willey).
Parialysus robustus (Nicholls).
Mesochra pygmaea (Claus).
Orthopsyllus rugosus Nicholls.
Laophonte cornuta Philippi.
L. longiseta Nicholls.
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Australomyzon typicus gen. et sp. nov.
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Acontiophorus zealandicus sp. nov.
Myzopontius australis sp. nov.
Cryptopontius similis sp. nov.
C. latus sp. nov.
C. proximum sp. nov.
C. longipes sp. nov.
Discopontius discoides gen. et sp. nov.
Bradypontius inermis sp. nov.
B. serratipes sp. nov.
B. ovatus sp. nov.
Pteropontius barbatus sp. nov.
Artotrogus latifurcatus sp. nov.
Hemicyclops australis sp. nov.
Paranthessius propinquus sp. nov.
Pseudanthessius tenuis sp. nov.

XIV. Spencer Gulf, dredgings; March, 1938.

Calanopia thompsoni A. Scott.
Longipedia australica Nicholls.
Peltidium proximum Nicholls.
P. speciosum Thomp. and Scott.
Eudactylopus australis Nicholls.
Parialysus robustus (Nicholls).
Laophonte cornuta Philippi.
Caligus sp.

XV. Reevesby Island, Spencer Gulf; 7/12/36.

Dysgenopsyllus reevesbyensis gen. et sp. nov.